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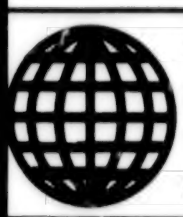

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NOTE TO READERS: Effective 1 October, the processing indicators appearing in brackets at the start of each item will be changed. All new indicators will begin with "FBIS" to make the material more easily identifiable. Some will also indicate whether the item has been translated from the vernacular or transcribed from English.

MICROELECTRONICS

NUCLEAR R&D

TELECOMMUNICATIONS

ADVANCED MATERIALS

Germany: Max Planck Uses High-Definition Electron Microscope for Materials Research

MI0809084294 Berlin NTZ in German No 7, Jul 94 p 522

[Text] The Max Planck Institute of Metal Research in Stuttgart has been operating Germany's most powerful electron microscope to date since the end of February 1994. The 16-million German mark appliance was financed one-third by the Federal Ministry of Research and Technology (BMFT), one-third by the Land of Baden-Wuerttemberg, and one-third by the Max Planck Society. The microscope column, which is 3 meters tall, is mounted on a 216-tonne antivibration foundation that renders it shockproof. The two high-voltage generator boilers are installed on the floor above. Good high-voltage stability is essential for the requisite resolution. The researchers in Stuttgart have thus developed a stabilization system unique the world over that keeps the 1,250-kV acceleration voltage exactly constant to a margin of less than plus or minus 1 V.

The ARM 1,250 Atomic Resolution Microscope, which raises resolution to 0.105 nm, provides materials and solid-state researchers with new opportunities for studying and characterizing crystalline materials at atomic level. The sample can be tilted by 40 degrees in the microscope and rephotographed from the new angle, thus providing information as to the three-dimensional structure of the crystal and revealing dislocations, inner interfaces, and grain boundaries in the materials being studied. Once the structure of a crystal is known, the mechanical or electrical properties of the solid can be enhanced by making targeted structural alterations. Pointers for more detailed studies are emerging in connection with semiconductors, ceramics, metals, composites, and intermetallic alloys.

As an example, figure 2 (not shown) shows a photograph of the regular lattice arrangement of a nickel aluminum crystal. Unlike images obtained with appliances used to date (resolution 0.17 nm), this now also shows the aluminum atoms, which are arranged between the nickel atoms at a distance of 0.14 nm. The interference patterns generated by the microscope result from the superposition of direct and deflected electron beams.

Access to the electron microscope, which was developed and built in Japan by the Japanese Electron Optics Laboratory (JEOL), is not limited to the Stuttgart-based Max Planck Institute's physicists, materials scientists, and solid-state researchers but is also open to companies and universities for particular experiments on materials.

German Research Center Exhibits Thin Film Coating Processes

BR2908080694 Berlin ETZ in German Jun 94 p 630

[Text] Thin film technology was one of the main themes of the Karlsruhe Nuclear Research Center (KfK)'s stand at the 1994 Hannover Trade Fair. One example is the cathode sputtering system for films of high temperature superconductors (HTSC). This device can be used to make thin films of HTSC and ferrites on substrates by shooting ions at a hollow cylindrical target. The particular shape of the cathode allows HTSC films to be produced that are normally sensitive to high-energy neutral particles in plasma streams when planar sputter sources are used.

The KfK has also developed a micromagnetostrictive separating filter, that is a bending tongue from a magnetostrictive amorphous film that is applied to a substrate by sputtering using "Physical Vapor Deposition" (PVD). The system bends under the effect of a magnetic field in a similar way to a bimetal strip or a piezoelectric element. The microfilter can be used as an actuator element in microsystems and clinical engineering, for example as a flexure beam for mechanical or electric circuits, as a local component actuator, or as a membrane for pumps or valves.

The KfK also showed tools and components with PVD protective coatings of various hard materials applied by sputtering processes. Coating concepts have been devised for various properties such as hardness, grip, toughness or cracking. PVD hard material coatings are suitable for resistant wearing parts, for tools for cutting metallic and non-metallic materials, and for forming.

The "Elba" electron beam coating plant consists of a footed cabinet with a window and a pulsed electron beam source with five channels. It can be used to work large substrates, e.g. metals, alloys, and inorganic and organic materials. Among other things, the system can be used for coating titanium clinical implants with aluminum oxide, for making electrical contacts on microcomponents, and for producing piezoelectric coatings for micromechanics. Stripping target material such as HTSC by electron beams is cheaper than methods using pulsed ultraviolet laser beams; the "Elba" device is also easy to retool.

European Materials Research Called Inadequate

94WS0494A Duesseldorf VDI NACHRICHTEN in German 5 Aug 94 p 8

[Article by Bettina Reckter: "Materials Research Still Remains Bogged Down"]

[Text] Stronger, lighter, more durable, and insofar as possible, still "more intelligent" materials than have existed before—such perhaps are the fundamental ideas which are guiding materials researchers in the development of new materials. Yet rarely do materials with new properties make a direct breakthrough onto the market. Promising projects gather dust in the drawers of scientists. That should be changed through a new initiative of the Federal Minister for Research and Technology.

Technical progress in many cases is possible only through the development of high-performance materials. However, until now researchers in the materials field have only very seldom informed themselves of the specific wishes of future users and important developments for which a great future had once been predicted have come to a standstill. Therefore Paul Krueger, Federal Minister for Research and Technology, at the time of his recent presentation of the research concept "New Materials for Key Technologies of the Twenty-First Century" in Bonn called for an exchange between developers and users in order to define the existing application potential on a timely basis.

Until now Krueger had spoken out very unsystematically on this subject. He called a "sorry example" the SQUIDs,

whose application at the time had still fallen far short of the hopes of developers. The abbreviation SQUIDs was assigned to magnetic field detectors which, for example, would pick up exceedingly small magnetic fields in the brain or in the heart which had been generated by nervous system electric currents by a contactless method. Indeed, the SQUIDs also are able to pick up magnetic signals which are a billion times weaker than those of the Earth's magnetic field and also promise to be of great importance for the functional diagnosis of structural components in the microelectronics industry.

Very promising projects are appearing, on the other hand, for such developments perhaps as particularly environmentally friendly ball bearings without lubricants or also chargeable synthetic material batteries with an energy output 400 W/hour/liter, which is four times that of the best batteries available today. Also of promise are some of the artificial muscles fabricated from special synthetic materials which with an increasing temperature or with the imparting of a stress are contracted. Included among the materials of the future there are also modern aerogels; these are highly porous materials from silicon dioxide or other metal oxides, from organic components or also from carbon, which in part are lighter than air. From such materials it would be possible to fabricate extremely good heat-insulating construction materials, as well as materials free of problems in the manufacturing process.

The new research concept of the BMFT (Federal Ministry for Research and Technology) could now drive the development of materials forward toward various focal points. Such is the case, for example, in the field of "structural ceramics," production of high-performance ceramics with special electrical, optical or magnetic properties. In addition, a search is being made for materials with which layers can be built up which are harder and more durable than a diamond. In the research focal point "powder metallurgy" a search will likewise be made for new alloys, as in the field "intermetal and superalloys," where in addition researchers are on the trail of high-strength light alloys. "New polymers," once again special synthetic materials, must be improved in their properties in such a way that they could be introduced as structural components for large flat projection screens or be inserted in light batteries. In the field of "binding materials" researchers are experimenting with new kinds of reinforcing fibers, such as with a metallic, ceramic or polymer matrix. And finally there is the research focal point "New Implant Materials" involving the development of resorptive implants and the production of biologically compatible implant surfaces.

It is basic that the research must be oriented on the future needs of industry making use of these materials. The emphasis lies on cooperative research, that is, on the coordinated collaboration of partners from industry and research institutes of institutions of higher education, of the Max Planck Society and Frauenhofer Company and from federal research organizations. The costs of the project will be jointly shared by industry and the Federal Ministry for Research and Technology.

Also the Office for Applied Science Results-Evaluation (TAB), which on the behalf of the Committee for Research, Technology and Applied Sciences Results of the Federal Bundestag has produced a number of studies on the theme "New Materials," regards research based on joint projects to be the most efficient research methodology under the given conditions. Nevertheless, an entirely new kind of procedure is being proposed for the allocation of research funds, as Edelgard Bulmahn of the TAB explained recently in a scientific press conference at Bonn. The research funds under this proposal should be distributed in the form of a loan to the collaborating industrial partners, by doing so the institute certainly also would be directly benefited in the future. The collaborating partner then would exercise its independent control and itself would decide on the further use of the results which it has achieved. Should these not be used by the partner, the state would assume the loan and with it also would acquire all the research results, which it subsequently would pass on as the need arises through a commercially organized technology transfer agency. Accordingly all participants would be afforded new opportunities in a competitively structured transfer of technology.

Bulmahn, however, feels that the timely getting together of researchers, developers and users is particularly important because in many cases the possible users have been entirely unaware of what is being done in the field of materials research and what may come from it. In this sense the loans should accelerate implementation of the project and at the same time there will be a 50 percent reduction of public funding, while in doing so the state would be able to step forward as a participating marketer.

The results of basic research are still certainly being transformed into industrially utilizable products too slowly. The deficiencies of the hitherto existing program for materials research must therefore be urgently rectified. The TAB studies in addition come to the conclusion that up to now it has been impossible to achieve a stronger involvement of small and intermediate enterprises—one of the principal target groups under the program.

Germany: Diamond Film Deposition on Silicon Studied

94F60340A Frankfurt/Main FRANKFURTER ZEITUNG/ BLICK DURCH DIE WIRTSCHAFT in German 4 Aug 94 p 8

[Unattributed article: "Augsburg Researchers Successful in Heterotactic Deposition"]

[Text]The capability to deposit single crystal films on an inexpensive substrate, for example on silicon, one of the most important materials in electronics, is an important requirement for the use of diamond in electronics. The University of Augsburg (Chair for Experimental Physics IV, Memminger Str. 6, 86135 Augsburg) has had initial success in this area.

Single crystal deposition is still a thing of the future, say researchers, but heterotactic deposition of diamond on silicon has already been proved at Augsburg. [This deposition] concerns a film which exhibits a fixed relationship to the silicon base. Although the film is not single crystalline, it clearly has better electronic properties than the usual polycrystalline films.

The diamond films are produced using a carbon-containing gas mixture, which is converted to a plasma by microwaves. The carbon vapor then condenses as a diamond film on the cooler silicon substrate. This low-pressure technique is also referred to as plasma-CVD (chemical vapor deposition).

Diamond has a number of properties for use in electronic components. It is better than all other materials, including silicon, with respect to heat conductivity, electrical insulation, and charge carrier mobility.

Diamond can be doped and then has semiconducting properties. Another advantage is its high temperature resistance. While a conventional silicon diode is destroyed at a temperature of 100 degrees Celsius, diamond diodes operate even above 500 degrees Celsius. The ability to tolerate high temperatures also permits considerably higher performance in electronics.

Nevertheless, it will be some time until a high-performance diamond chip is available, say the Augsburg scientists. The deposition technology has been well developed and scientists are working intensively on production of single crystal diamond films, but doping with impurity atoms, through which the film acquire type semiconducting properties, remains difficult as before. There are already p-type semiconducting diamonds. A suitable method of producing n-type semiconducting diamond must still be found.

France: "Diamite's" Structure Identified

94P60364A Paris AFP SCIENCES 31 Mar 94 p 15

[Unattributed article: "Diamite", a DNA-Type Helix Shaped Diamond]

[Text] According to an announcement in CNRS Info (1) Bulletin's latest issue, a French team of chemists has determined that "diamite"—a form of carbon harder than diamond—has a helix type structure.

M. Pham V. Huong, who is the head of this research team affiliated to CNRS- University of Bordeaux-1, believes that "diamite will certainly revolutionize micro industry." In fact, this very resistant compound is an ideal material for everything related to surface treatment in aerospace industry and in machine tool development. Producing "diamite" is very simple; for example, this "miracle material" may be obtained through vapor phase deposition or cathodic pulverization of methane or carbon monoxide.

The research team identified diamite's helix type structure, of one or many strands, through measuring the length of bonds between two carbon atoms by Raman spectroscopy.

Not unlike graphite, diamite is made up of parallel piles of carbon atom planes where the solid carbon-carbon bonds between two planes give it a -DNA shaped—structure very similar to that of a diamond. Midway between graphite and diamond, diamite is thus composed of carbon atoms sticking out of the graphite planes.

This tridimensionality is what makes diamite harder than diamond. Graphite, on the other hand, due to its bidimensional structure, is more friable than both diamond and diamite.

For this discovery, Pham V. Huong, head of the molecular and crystalline spectroscopy laboratory, has received the American-Japanese MRS-ISTEC prize (Materials research Society- International Superconductivity Technology Center).

A French-Russian team (2) had already obtained diamite first in February 1993 by compressing carbon-60 (fullerenes), when they also have proved it to be harder than diamond. At that time, however, they were not able to clarify its structure(3). This new diamond could cause—well—a..."dynamite effect".

(1) "CNRS Info" no. 283 (1 April).

(2) Troits (Moskow Oblast) Vereshchagin Institute and Paris-IX University's Amorphous Materials Physical Chemistry Laboratory.

(3) See "CNRS Info" No. 258 (1 February 1993) and No. 275 (1 December 1993).

AEROSPACE

European Space Agency Studies In-Orbit Satellite Service Vehicle

94WS0473A Noordwijk ESA BULLETIN in English May 94 pp 33-39

[Article by W. De Peuter, G. Visentin, W. Fehse and A. Elfving, ESA Technical Directorate, ESTEC, Noordwijk, The Netherlands; D.L. Brown and E. Ashford, ESA Telecommunications Directorate, ESTEC, Noordwijk, The Netherlands: "Satellite Servicing in GEO by Robotic Service Vehicle"]

[Text] The geostationary orbit has a high commercial and strategic value, as do the satellite systems stationed there, for telecommunication, TV broadcasting, and weather forecasting. To safeguard the huge capital investments made as well as the usability of the orbit itself, it will soon be necessary to have adequate means of remote intervention for the servicing and repair of satellites. Since the physical, technical and economic constraints of such a mission make servicing by astronauts impossible, robotic service vehicles will have to do the work. ESA is now studying a robot-based Geostationary Service Vehicle, which would be similar to deep-sea and nuclear servicing robots.

Introduction

ESA is presently investigating the characteristics and potential of a Geostationary Service Vehicle (GSV) which could provide in-orbit inspection of geostationary satellites and intervention when necessary. So far, three types of services or "interventions" have been identified:

1. Inspection of a satellite that has a severe malfunction and where a close-up view of the satellite could help to clarify the problem. This diagnostic data can be a basis for recovery actions from ground.
2. Mechanical assistance to a satellite in trouble, for example, with a non-deployed solar array or antenna, to restore operation.
3. End-of-life re-orbiting of uncontrolled satellites into a graveyard orbit, an operation that will become more and more important in order to maintain the commercial exploitation potential of the geostationary orbit (GEO).

As was demonstrated recently with the successful repair of the Hubble Space Telescope, very good servicing results can be obtained if the subject satellite is built with the intention of being serviced later. However, because of the existing fleet of conventional satellites, a GSV must also be able to perform meaninful intervention tasks on commercial spacecraft that are not designed for in-orbit servicing.

GSV System Overview:Concept Feasibility

The baseline thinking is that a GSV should "pay for itself", at least once it is in orbit. However, its capabilities and services must be sufficiently comprehensive to be attractive to satellite operators. This means that in order to be commercially viable both the development and operational costs must be kept within very tight bounds. Many of the enabling technologies for a GSV exist but still need to be adapted for use in space and to be proven in flight. A number of technological challenges also still need to be resolved, including the rendezvous, circumnavigation and approach to a non-cooperative spacecraft followed by its robotic capture and berthing.

Typical target spacecraft are spinning or three-axis stabilized telecommunication satellites positioned (or drifting) along the GEO arc. Examples of satellites with real problems for which a GSV could have been very useful are given in Table 1.

Table 1. Examples of satellites for which GSV services could have been very useful

Satellite	Problem	GSV action
Olympus	Satellite in unknown configuration and not controllable	Close-up inspection
Anik-E2	Only partial deployment of C-band reflector	Close-up inspection/mechanical intervention
TV Sat1	Non-deployment of solar panel	Mechanical intervention
Marecs-A	Solar array drive stuck	Mechanical intervention

Commercial Potential

From an economic point of view, mechanical interventions are the type of GSV intervention with the greatest revenue potential. However, since spacecraft failures are unpredictable, it is difficult to base a commercial plan on the intervention missions alone. Re-orbiting missions, on the other hand, could provide a more steady income. If it was planned to move the spacecraft when depleted from its operational slot into a graveyard orbit using a GSV, a telecom satellite could continue operating until propellant depletion (roughly six months of extra exploitation). Additional revenues would be generated, and a reasonable share of this extra profit could be claimed by the GSV operator. These otherwise"dead" would be a collision hazard to other satellites. For inspection tasks, revenues are expected to be low, although they could become considerable if the inspection leads to the recovery of the satellite.

It is estimated that a GSV could become economically viable if the design costs of the GSV can be kept in the range of two to three times the launch cost. This could be achieved by maturing the required technology via separate technology programmes to reduce the design risk. Here, ESA could play a key role in mobilizing the available European expertise to provide a technical and commercial basis for a GSV.

Basic GSV Configuration

The proposed configuration for a GSV (Fig. 1 not shown), synthesised during ESA's recent industrial study, is a satellite that would use the maximum upload capability of a dedicated Ariane-4 launch, thus a 4.2 ton spacecraft at launch. With a dry mass of approximately 1.2 tons, roughly 3 tons remain for fuel, which means a total delta-v of 3687 m/s (for a bi-propellant with a specific impulse of 300 seconds). The hexagonal configuration proposed uses the full fairing diameter of the launcher, and the height of the spacecraft is sized in proportion to the three tons of fuel. Solar panels would unfold from the outer surface of the hexagon, and the rendezvous sensors, the robot arm and its tools would be located on the top surface of the GSV. The bottom surface would be dedicated to the launcher interface ring and the GSV propulsion system.

GSV Operation

It is proposed to operate the GSV through a dedicated, portable ground station. The S-band would be used for communication and the dedicated station would be co-located with the customer's main ground station. A key driver in the design of the antenna arrangement on board the GSV, will be the continuity of the communication link during all proximity operations. Low gain S-band antennas with wide lobes are proposed, especially for approach operations when the target spacecraft may obstruct the GSV antenna visibility.

GSV Orbital Maneoeuvring: Fuel Consumption and GSV Lifetime

The primary requirement for a commercial GSV is its capability to reach as many target spacecraft as possible during its operational life. Once launched and positioned at its "home" location, the GSV's ability to reach a troubled satellite is directly related to the amount of fuel the GSV operator is prepared to expend. The main fuel consumption parameters are the speed at which the GSV moves along the orbit, the phasing and inclination differences for which correction is needed, and the number of re-orbiting operations. Based on a scenario consisting of 25 re-orbiting missions, 10 inspections, 3 mechanical interventions, and 2 dead satellite removals, the proposed GSV configuration would have an operational lifetime of five years.

Rendezvous

The basic phases of a rendezvous are illustrated in Figure 2 [not shown]. After a call for assistance, the GSV begins the transfer to the troubled satellite by moving from its home position toward the target spacecraft, with a drift orbit a few hundred kilometres below the geostationary

orbit. When it arrives within 10 km of the target spacecraft, the GSV is transferred back to the geostationary orbit (points S1 to S2). The GSV then approaches the target carefully (S2 to S4) and circumflies it to obtain status information (S4 to S5). The GSV then makes its final approach in preparation for capturing the target.

The rendezvous is performed with the help of ground tracking, radar tracking or angular measurement with a star-tracker, and eventually TV- camera tracking.

Final Approach

When the GSV is within 50 metres of the target spacecraft, it begins its final approach and using its robotic arm, captures the target (S6 to S7). The target is docked to the GSV itself and later they are "rigidized" so that both spacecraft form one rigid compound. The robotic servicing intervention can then begin.

The GSV approaches a controlled satellite stabilized in its nominal Earth-pointing position from behind, along the Earth direction. In the case of an uncontrolled satellite, the target is expected to spin slowly around its main axis of inertia; for most satellites, this axis is perpendicular to the solar-array plane. The GSV then makes its final approach along the spin axis of the target satellite. At the very last moment, the GSV (or possibly its robotic capture tool) will be spun up to synchronize with the target.

For both controlled and uncontrolled satellites, it seems realistic to assume that the GSV can maintain a relative position and attitude accuracy of + over -5 cm and + over -2 degrees with respect to the target. This does not apply for the roll axis of a spin-stabilized target since the roll-motion synchronization will be done by a rotating capture tool. Possible nutations around the spin axis could be compensated by the robot holding the capture tool. After capture, the GSV will slow down the rotation of the target until both spacecraft attain the same rate. The "rigidization" between the two can then take place; the single point attachment between the two spacecraft is replaced by a more stable, multi-point fixation structure to strengthen and stiffen the bond between the GSV and the target satellite and to free the robot arm for other uses.

GSV Robotic System: Why Robots?

A GSV will be uncrewed, and the broad variety of tasks to be done, in combination with the unpredictable nature of the servicing tasks, calls for a flexible and multi-functional flight segment. Robotic systems are the only means available today to fulfil these needs. In addition, a robot can be controlled in a telemanipulation mode by a remote ground operator. In the case of a GEO-stationed spacecraft, the direct telecommunication link enables a good band-width. Because of the short time delay between ground control and the flight segment, the GSV robot can be operated in a telemanipulation mode of very good quality. This means that the motion of a ground master arm manipulated by a skilled operator, can be "slaved" by the GSV robot and, in that way, quasi-human repair capabilities can be obtained.

As far as the robotic interaction with a conventional satellite is concerned, two major problems appear:

1) The limited options for capture/berthing and docking
2) The accessibility of the repair area for the GSV robotic system.

Robotic Capture, Berthing and Docking

The robot arm must capture the target satellite, berth it to the GSV to align the axes of the two spacecraft, and dock it firmly. On a satellite that is fully covered with thermal insulation, there are few possibilities for proper mechanical interfacing with the GSV. However, two "hard points" that are available on virtually all GEO satellites are the nozzle of the apogee boost motor and the launcher interface ring. The nozzle may not provide sufficient stiffness for use as the final docking interface but could serve as a first "hook" for capture and temporary attachment. Rigidization between the GSV and the launcher interface ring can then be performed. Due to a lack of standardization in nozzles and interface rings, the capture and rigidization mechanisms of the GSV must be highly adaptive.

An example of a nominal GSV manoeuvre with a stabilized target is illustrated in Figure 3 [not shown]. The GSV will service the Anik-E2 satellite, whose C-band reflector had only partially deployed. The GSV robot first prepares the spacecraft by erecting the docking/rigidization structure (Fig. 3a) [not shown] The GSV then approaches Anik-E2 from behind (Fig. 3b) [not shown] and captures it by its main engine nozzle (Fig. 3c) [not shown]. The robot will do this using a dedicated capture tool. In the case of a spinning spacecraft, the GSV will be spun up to the same speed along the same axis. The capture tool's "stinger" is inserted via the nozzle in the combustion chamber and expanded to prevent the target from escaping. Then the capture tool clamps to the outer ring of the nozzle to achieve a greater stiffness. The robot arm berths the spacecraft to the GSV (Fig. 3d) [not shown] by latching the other end of the capture tool into its fixed position. The robot arm is now released and picks up a gripper from its toolbox (Fig. 3e) [not shown]. The robot then performs the intervention: it reaches for the stuck antenna, releases it and deploys it into its operational position (Fig. 3f).[not shown] In the case of an uncontrolled tumbling target (Fig. 4) [not shown], the capture tool will be spun up in synchronization with the rotation of the nozzle. The robot arm also compensates for part of the orbital motion by keeping the capture tool aligned with the nozzle. It is expected that the images provided by the rendezvous camera on the main body of the GSV will give sufficiently accurate information so that the robot arm can safely insert the stinger of the capture tool in the combustion chamber. During insertion, the robot will continuously adjust its motion based upon distance and contact force measurements. After latching, the robot arm and the capture tool will gradually eliminate the tumbling motions, and the berthing and docking of the two spacecraft will then follow.

Robotic Mechanical Intervention

The intervention for servicing can be divided into three sub-phases:

1. Reaching the repair zone
2. Close inspection of the repair zone
3. Intervention using tools, e.g., removing and replacing sections of the thermal blanket severing restraint cables

that prevent deployment of the antenna or solar array, or hinging/removing deployable mechanisms that are stuck.

A major disadvantage of the capture and docking concept described, is the distance (roughly 5 metres) between the repair area and the GSV. Indeed, most of the defects are expected to be at the other extreme of the satellite where the payloads and subsystems, such as antenna reflectors, are located. It will require innovative robotic systems that can easily access the servicing area and at the same time provide good local precision, dexterity and stiffness to enable a good repair.

Robotic Concepts

An obvious solution is to have one or two large robot arms that operate from the top face of the GSV and which can access the service zone directly. This straightforward solution can adequately solve the accessibility problem but a severe limitation is that these big crane-type robots have limited manipulation capabilities. First, the precision is in the order of centimetres or even decimetres which is often insufficient for repair work. Secondly, the local dexterity, i.e., the freedom of motion available at the robot tip, in this stretched position, is generally quite poor. This necessitates a very specific tool set to compensate for these limitations, implying less universality and less possibilities to cope with unforeseen defects.

Another candidate concept is a micro-macro manipulator. This is a cascase configuration of a large manipulator carrying a small, instrumental robot. Technically, this is a very attractive solution since both robots complement each other well. The large one acts like a cherrypicker-crane that carries a small, dextrous robot (often with two arms) to the repair zone to do the precise part of the work. This concept is popular on ground and in LEO, but the equipment tends to be heavy and the concept is less effective in GEO where every kilogram counts. It is also a more expensive solution which jeopardises the potential commercial future of a GSV.

At the research level, new robotic concepts are being developed which could be very useful for later versions of a GSV. For instance, there are already testbeds of a small robot which is able to build a lightweight structure (e.g. a truss) on its own, and over which it can move easily. Such a scaffold could provide a universal structure used to bring a small instrumental robot to where it is needed.

Robotic Tool Set

In the same way as a human worker needs a comprehensive tool set for repair tasks, a GSV robot cannot perform all the tasks mentioned with one universal end-effector. A number of tools that are required were identified in the industrial study:

- a satellite-capture tool
- a docking/rigidization tool
- a satellite close-up inspection tool
- a two-finger gripper
- a cable/pin cutter
- a self-reacted lever-force tool

Some tools, such as inspection cameras, can be permanently mounted on the robot arm. Others must be detachable end-effectors, preferably designed as a modular family to minimize mass and volume.

Control Concept

The GSV proximity and robotic operations normally require complex control systems. However, due to the availability of a continuous and direct communication link, the general control concept for a GSV is to have only the bare minimum of control functions implemented on board. For rendezvous, these necessary on-board functions are to ensure attitude and position stability, and back-up procedures to ensure the integrity and health of both the GSV and target satellite, in case ground control is lost. For robotics, the control functions on board are to ensure robot arm motion stability and accuracy, and to perform guidance for time critical motions such as the capture of a target satellite.

Spin-off Potential

The similiarity between robotic servicing in GEO and deep-sea exploration and exploitation and nuclear-reactor servicing is striking. Remote intervention in hostile environments is expected to become increasingly important in the future, with new applications such as in the clean-up of radioactive or toxic waste, firefighting, de-mining, the handling of explosives or inflammable materials, security and police work, telemedicine, and in many other areas. A technology programme for the development of a GSV could act as a precursor to robotic servicing in the other environments, offering promising potential spin-off benefits to those terrestrial applications.

Acknowledgement

The authors would like to acknowledge DASA in Bremen and Ottobrunn (D) and its subcontractors, SPAR in Toronto (Canada), GMV in Madrid (E) and ESYS in Guildford (UK), which have studied Geostationary Service Vehicle concepts under ESA contract.

France: ONERA's Latest Simplified 'Rustic' Ramjet Described

94WS0495A Paris SCIENCE ET VIE in French Aug 94 pp 100-101

[Article by Serge Brosselin: "A Rustic Ram Rocket"]

[Text] **Military missiles do not escape the hard law of compulsory profitability. But although it costs less, France's new "rustic" rocket engine is still the best performer in its class.**

The new missile rocket engine developed by the National Office for Aerospace Studies and Research [ONERA] is disconcertingly simple. Since it lacks many of the components essential to competing missile engines now existing in the world, the "rustic ram rocket probationary engine," or MPSR, is lighter, easier to manufacture and use, and above all, makes a not inconsiderable reduction in cost possible.

What makes the new missile revolutionary? To understand the answer, we must go back over a few basic notions, namely, the way in which a rocket and a ramjet engine operate and why those two means of propulsion are

combined. The ramjet is the ideal engine for a missile: since it can reach very high speeds (beyond Mach 5), it can be used against the fastest targets (aircraft rarely exceed Mach 3.2, and only the SR-71 and MiG-25 are capable of achieving such speeds anyway). The problem is that a ramjet engine, having no moving parts, can neither draw in nor compress the air it needs in order to operate. Hence the need to first bring it to a high speed—on the order of Mach 2—so that the outside air will enter with sufficient pressure. That is why it is combined with a rocket engine. So at the start—from a launch ramp on the ground or the deck of a warship or from under an aircraft wing—the rocket engine propels the missile to the proper speed allowing the ramjet to start up.

Many missiles function in that way. But those missiles are relatively heavy, and both their structure and their operation are complex. In fact, they carry two very different engines, each with its own fuel, fuel tank, exhaust nozzle, and control electronics. In most cases, the entire system is arranged in two stages. And separate orders issued by an on-board electronic system are needed to trigger the various operations necessary for normal flight—ignition of the rocket engine, acceleration, and then, at the proper speed, pressurization of the kerosene tank, ignition of the (ramjet's) cruise module, and jettisoning of the rocket stage.

The major new feature of the ONERA's rustic rocket engine is that all that complexity has been eliminated. The MPSR is, in fact, stripped to the bare essentials:

1. Only one control system, the one controlling initial ignition, is enough to set off the chain of flight phases: ignition, acceleration, transition, and cruise (see the illustration) [not included].
2. The nozzle for the rocket portion is carved into the block of solid fuel, which itself is made of a compact butalane powder.
3. When the butalane is completely consumed, the space thus made available in the body of the missile becomes the combustion chamber of the ramjet, and the hole at the back becomes the exhaust nozzle.
4. The disappearance of the butalane automatically opens up the air intake hatches (see the illustration) [not included].

Original, no? That is not all. The fuel burned by the MPSR's ramjet is not a special liquid propellant,[1] which requires its own tank and the use of which can be a tricky matter.[2] Nor is it kerosene, which is traditionally used in some ramjet engines and must be pumped out of the tank and injected into the combustion chamber. This means that there is neither fuel tank nor pump on board the MPSR.

The composition of the miracle fuel in question is top secret. It is known, however, that it contains the same ingredients as the fuels used in rocket engines, although the quantity of propellants is proportionately greater than the quantity of oxidizers. It is also known that it has the consistency of both a thick gel and semiflexible rubber and that its density is 1.2, compared to 0.8 in the case of kerosene, with the result that specific impulse is improved.[3] Its combustion is pyrophoric; it is ignited by contact with air entering from the outside. It then releases a combustible gas under high pressure that is injected into the ramjet combustion chamber and ignites spontaneously because of the prevailing temperature.

Control of the ramjet during the cruise phase is also original: it is guided automatically by variations in altitude and in the temperature,and thus the density, of the air. True, the system is relatively crude and less flexible than the highly sophisticated electronics that manage the flight plans of some missiles and make them more maneuverable (especially air-to-air missiles). But it is nevertheless a high-performance system and, above all, a simple one.

By making it extremely compact, all these unusual solutions being applied to the new rocket engine optimize the missile's energy efficiency. At equal performance levels, its consumption is three times less than that of a conventional engine using solid fuel. And compared to other engines with the same dimensions, its useful range is doubled, as are its average speed and maneuverability.

Industrialization of the rustic ram rocket will take place at the conclusion of a program developed by MATRA [General Company for Mechanical Engineering-Aviation-Traction]-Defense. At the moment, however, the military planning law does not provide for any weapon system based on the MPSR. But exploratory research regarding that propulsion method has been underway for about 10 years, and it is continuing actively today.

The first tests took place in 1984-85 using a small demonstration model designed to prove the missile's surface-to-air interception capabilities against any hostile vehicle up to an altitude of 6,000 meters. Trajectory speeds of from Mach 2 to Mach 2.8 were recorded at that time. The ONERA has now undertaken to improve the missile's performance: a wider flight envelope, speeds of up to Mach 4.3, possible ranges of from 25 to 100 km (depending on the direction of the launch), a starting acceleration of 25 g, and an operational ceiling of 20,000 meters. All of that makes the MPSR-2 (shown in the photograph [not included]) the number one missile in its class—that is, the class of "small missiles" with diameters of from 150 to 280 mm. MATRA is very certain to eventually become the first missile manufacturer in the world to develop a missile based on rustic technology.

Result: in situations where a conventional missile like the Exocet, the Otomat, the AS-30, or the (antiradar) Armat would be limited to air-to-surface or air-to-sea missions, a missile with rustic ram propulsion would add low- and medium-altitude surface-to-air missions to its range of possible operations. Only air-to-air missions would remain restricted to MICA's (air interception and combat missiles), another MATRA product. That last-named type of mission makes it necessary to use the sophisticated engine control systems mentioned above, which the rustic rocket engine lacks.

Footnotes

1. A substance or set of substances containing an oxidizer and a fuel. They are either liquid (for example, a mixture of kerosene as the fuel and liquid oxygen as the oxidizer) or solid, in which case they are called powder propellants.

2. For example, if a missile is not used during a mission, the tanks must be emptied of their liquid propellant, which is extremely corrosive.
3. This refers to the time during which it applies one unit of thrust to one unit of mass.

AUTOMOTIVE INDUSTRY

New Invention To "Revolutionize Power Transmission"

LD1409192794 Helsinki SUOMEN YLEISRADIO NETWORK in Finnish 14 Sep 94

[Excerpt] A Finnish invention was revealed in Outokumpu in northern Karelia today. It is expected that this invention will revolutionize power transmission. The invention is a mechanical gear that operates without graduations and without a clutch. The invention can be adapted for vehicles and machines in industry. The invention makes power transmission easier and more effective. [passage omitted]

The mechanical gear has only been patented in Finland. A corresponding invention has been developed with big money in Italy, among other places, but so far without results.

BIOTECHNOLOGY

Amended Biotechnology Law Invigorates German Pharmaceuticals

94WS0501A Duesseldorf VDI NACHRICHTEN in German No 32, 12 Aug 94 p 9

[Article by Christa Friedl: "Guidelines for Genetic Engineering Clarified"]

[Text] The discussions concerning genetic engineering have finally yielded results. Both advocates and critics now agree that biotechnology will indeed be instrumental in making great progress in the war against disease, although not as quickly or as simply as thought a few years ago. However, the use of genetic engineering in plant and animal cultivation remains contested.

No other scientific discipline has been accompanied by greater hopes and expectations than has biotechnology. Champions of the new field from industry, politics, and science continue to promote the notion that genetic engineering will put an end to hunger throughout the world, that it will cure all kinds of diseases, and that it will rid the environment of harmful substances. In consonance with these hopes and expectations, market value estimates have ascended to astronomical heights. In the year 2000, it is estimated that the world biotechnology market value will be somewhere between DM100 billion and DM170 billion.

But on closer examination, the hopes and expectations are but dreams and illusions. Dr. Peter Stadler, director of the biochemistry process department at the Bayer chemical company in Leverkusen, states flat out: "Genetic engineering will never solve the problem of world hunger." Dr. Beatrix Tappeser, a biologist and member of the board of the Freiburg Ecological Institute, elaborated further: "World hunger is a problem of limited resources and inadequate food distribution; it has nothing to do with technology."

In the medical field, too, extravagant hopes and expectations have been deflated. The development, testing, and official approval of a genetically engineered medicine has proven to be a far more time-intensive and expensive process than originally thought. And, finally, the field of environmental protection has profited very little from genetic engineering. The proposed release, for example, of genetically manipulated bacteria to destroy certain harmful substances in the ground or in water appears too risky an undertaking at the present state of the art. Theoretically, the techniques used in genetic engineering permit the genes for specific desirable properties to be isolated from one organism and to be introduced in another. Discussions have been held for many years as to what the precise possibilities really are in this very broad field. Meanwhile, research is concentrating strongly on pharmaceuticals. As early as the year 2000, some 10 percent of the world pharmaceutical market is expected to be held by test-tube medicines.

On the way to this goal, the German pharmaceutical industry now appears to have been helped considerably by the law-makers. Biotechnology has been provided a strong tonic by the law dealing with genetic engineering as amended in December 1993. Dr. Dieter Brauer, specialist in biotechnology at Hoechst AG in Frankfurt and chairman of the biotechnology/genetic engineering committee in the Association of the Chemical Industry (VCI), believes that "research and production with genetically engineered organisms will now be easier in Germany." Now, research projects need only be reported to the authorities, the time required to win approval to establish production facilities has been cut by several months, public participation in safety stage 1 has been eliminated, and in safety stage 2, this participation has been limited to formal written objectives.

At a recent VCI symposium in Frankfurt, Hans-Juegen Schuster, chairman of the VCI biotechnology working group, said: "Over the past decades, medical research has succeeded in extending human life to unprecedented lengths. Now, efforts must be undertaken to ensure that an acceptable quality of life can also be provided in old age." Alzheimer's disease, Parkinson's disease, and osteoporosis are just a few examples of old-age maladies that researchers throughout the world are trying to understand, but without completely satisfying results as yet.

Genetic engineering research can show more success in so-called substitution therapy. So far, six active substances, produced through genetic engineering, have been approved for the market, namely, insulin, interferon, growth hormones, TPA, erythropoietin, and factor VIII. Moreover, production will soon begin of hirudin, an agent to prevent blood clotting, and the antibiotic cephalosporin.

Insulin has hit the headlines quite often in Germany. On 16 June, after an 8-year process, the Hoechst Chemical Company in Frankfurt finally received approval for the much discussed genetically engineered human insulin. Unfortunately, even human insulin can only improve the quality of life for diabetics to a limited degree. Its effect

only lasts for a few hours, after which further injections must be made on a continuing basis. In order to force the blood sugar to a normal level for a longer time, the "Hoechst Form" of the hormone must be used. This means that the structure must be changed by exchanging and introducing amino acids. Of 16 probands tested, one promising molecule, which was altered chemically in three places, remained. A mixture consisting of this "di-arg-insulin" and the unaltered human insulin can remain effective for ten to twelve hours. However, it is not expected to appear on the market before 1998.

Researchers throughout the world have great hopes for the genetic therapy in which defective body cells are removed and reprogrammed through genetic engineering. In this regard, they are now producing some substances a body lacks as, for example, the blood clotting factor for hemophiliacs or the growth factor to overcome dwarfism. In Germany, the first experiments in genetic therapy were begun in Freiburg University in late April. Scientists there introduced the gene for the production of Interleukin-2 (IL-2) into connective tissue cells taken from cancer patients. It is well known that IL-2 plays an important role in fighting virus-infected cells or cells that have become cancerous. The transgenetic fibroblasts are mixed with inactivated cancer cells and the mixture injected under the skin of the proband. The altered fibroblasts ensure that the body's immune cells are lured to the vicinity of the tumor, where they destroy the diseased cells. The scientists expect their first conclusive results next spring.

While genetic engineering is an indispensable tool in pharmaceutical research, its use for the development of plant varieties with specifically tailored properties is being viewed far more cautiously today than a few years ago. Helga Anna Umbach of the Planta Research Society of the Kleinwanzleben Seed Nursery in Einbeck cites three reasons for this. First, the development of new plant varieties by means of genetic engineering requires from eight to ten years, or about as long as if they were developed by conventional means. Second, plant cultivators fear mass opposition to the release of genetically altered plants. And thirdly, but not least, the food industry itself doubts that consumers will accept food derived from genetically engineered products. Consumers have for some time now recoiled at food products so characterized.

Nonetheless, plant cultivators like Planta continue to bet on the future of transgenetic plants, into which resistance against disease-causing agents have been introduced. Umbach explains: "The use of poisonous pesticides can only be significantly reduced by the development of such plants. However, the experiences of recent years have made others lose their taste for such plants. Thus, for example, Bayer AG has temporarily stopped its development of herbicide-resistant varieties. Its research had turned out to be more expensive and time-consuming than expected. In addition, the company wanted to wait for the legal decision before proceeding. But the real reason was quite simple. Dr. Hans-Joerg Reif of the Bayer Plant Protection Center in Monheim summed it up: "No one can afford to pay the costs involved in the development of such plants." Further discussions will be held in the autumn to decide whether Bayer will again try its hand in plant cultivation.

Photo Caption [not shown]

1. p. 9 (upper center): Hemophiliacs whose blood clotting mechanism is defective look optimistically to a therapy with Clotting Factor VIII, which is produced through genetic engineering. Our photo shows the production container (fermenter), in which genetically altered mammal cells produce Factor VIII.

EU Moves To Promote Bioengineering Research

94WS0501B Duesseldorf VDI NACHRICHTEN in German No 32, 12 Aug 94 p 9

[Article by Christa Friedl: "Production Involving Organisms Altered by Genetic Engineering Eased Significantly"]

[Text] *The European Union (EU) is attempting to catch up with international genetic research. Basic guidelines will be loosened by the end of the year. When that is done, research and production in the field of genetic engineering in the EU will finally be rid of many bureaucratic constraints.*

Even today, far more techniques, procedures, and processes in Europe are being influenced by biotechnology than would be seen at first glance. The Senior Advisory Group Biotechnology (SAGB), an industry specialist forum under the aegis of the European Chemistry Association, states that "the industrial branches in which growth is directly influenced by biotechnology constitute about 9 percent of the EU's gross net product (having a yearly total of 450 billion ECUs) and 8 percent of the work places." Biotechnology will be a driving force of the economy in the coming century.

Research, production, and transport involving microorganisms, plants, or animal cells that have been altered through genetic engineering have been regulated by a multitude of guidelines in the EU. The guidelines for work with transgenetic organisms in closed containers (production guideline), the release guideline, and the guideline for the protection of workers against transgenetic material all date from the year 1990. The guidelines for patenting genetically manipulated material, for the transport of transgenetic organisms, and for the production of new kinds of food are new and still under discussion.

Unfortunately, in the opinion of the industry, these guidelines have not exactly promoted or helped biotechnological activities in the EU. Quite the contrary. To this point in time, the SAGB complains in its new brochure entitled "Biotechnology Policy in the European Union," mostly unreasonable, arbitrary decisions have been taken at the Union level, even though the individual member states themselves have reasonable regulations. Often industry is not adequately consulted when new regulations are drafted.

This will all change however. Just two years ago, a guideline of the EU spoke of work with genetically altered organisms in the same breath as working with radioactive waste and sevesodioxin, emphasizing mostly the dangers entailed. Now, the chapter on biotechnology has been rewritten in the EU. Pragmatic and economic interests have won the upper hand in the last two years. Biotechnology, together with genetic engineering, is now officially recognized as one of the most important cutting edge technologies of the 21st century

Typical of the new appreciation and acceptance of biotechnology is the definition of a newly established 556 million ECU program for safety research to run to 1999. Dr. Manfred Schmitz, associated with EU's General Directorate of Industry, stated bluntly:" In future, we will not allot any more money to prove that biotechnology is safe." Funding will be used almost exclusively to develop market-ready products.

Germany has not been as disinterested in genetic engineering as the statistics might imply. According to one VCI (Association of the Chemical Industry) study, the focal point of investments made by German companies engaged in genetic engineering has been their own country. The study indicates that investments totalling DM340 million have been made for the period 1992 to 1996; DM153 million has been invested in the other EU countries; DM279 million in the United and Canada combined; and DM2.5 million in Japan. Dr. Alfred Bach, biotech specialist at BASF, puts the picture in perspective: "Of the 50 best molecular biology institutes in the world, 24 are in the EU, and nine in Germany alone." The VCI complains that "the improvements achieved by the amendment of the genetic engineering law still do not create the same good working atmosphere and conditions as exist in the United States and Japan. Consequently, the EU Commission wants to remove some major obstacles. First, the currently existing separation between research and production will be lifted. The approval procedures will accordingly orient themselves only to the potential danger of the organisms used and no longer to the container volumes. Second, work with organisms of safety stage 1 (no risk) and safety stage 2 (slight risk) will be simplified. In the future, in the case of stage 1 work the authorities can be notified informally, without submitting official forms. In the case of stage 2 work, the authorities are obliged to process all applications within a period of two months. Approval can only be delayed when there are substantial misgivings. According to EU specialist Schmitz, the drafts of the amended guidelines are already ready to be submitted to the Council of Ministers.

On the other hand, the Commission wants to delay a bit with the amendment of the release guideline. Schmitz explained: "We still do not have enough experience to make specific changes." There is a big difference between spatially limited and spatially unlimited releases. Thus, experiments with transgenetic plants to be conducted on a single acre would have a shorter and simpler approval process than the release of microorganisms that may propagate uncontrolled. As Schmitz notes: "The risk involved in the release of a rabies agent has to be classified and handled quite differently than the release of a petunia variety." Moreover, the general public has to be kept thoroughly informed about all such experiments in order to win its confidence and gain its acceptance.

Amended guidelines do not by themselves, Schmitz believes, guarantee an improved state of German competitiveness on the world market. In order to match the competition from the United States and Japan, the harmonization of the guideline text must be matched by a harmonization in practice. "Unfortunately, Europe often does not enter the field of biotechnology in concert, but often at odds with each other."

German Biotech Labs Said To Lag in Field

94WS0501C Duesseldorf VDI NACHRICHTEN in German No 32, 12 Aug 94 p 10

[Article by Dr. Siegfried Greif: "Genetic Engineering Without Germany?": German Patent Applications Have Been Declining Since 1990]

[Text]Once again the competitiveness of an industrial branch is reflected in patent statistics. Dr. Siegfried Greif, biotechnology expert in the German Patent office in Berlin and author of the following report examines current developments. He concludes that the recent more liberal legal decisions have so far failed to generate an upswing in German genetic engineering labs.

The stormy development of biotechnology has continued unabated now for almost two decades. It stretches over the entire innovation spectrum, from the initial special scientific basic research to the marketing of new products. The scope and content of this spectrum can be marked by two critical high points: First, the Nobel Prize for Chemistry and Medicine in 1993 was awarded to four scientists for their achievements in biotechnology, especially genetic engineering. Second, the world market for biotechnological products for the year 2000 is estimated at DM170 billion.

Development of the World Market for Biotechnology Products to the Year 2000 in Billions of US Dollars

Product	1990	2000
Biotechnology, total	6.4	105
Agriculture, food	3.0	50
Pharmaceuticals, health	1.5	30
Chemicals	0.1	18
Environmental protection	0.5	3
Instruments	1.3	4

Source: SAGB

The overall development of biotechnology can be traced back to the great scientific breakthrough in the 1970s, when it was found that the genetic makeup of microorganisms could be altered through the introduction of other (external) genetic information and that certain desirable genetic characteristics could be multiplied. This finding made it possible to utilize microorganisms to generate new unusual products.

The discoveries and innovations made throughout the world in this new science, as documented in patent data, can be divided into two phases. Up until the year 1979, patent activity remained at about the same level. Commencing in 1980, however, a sharp constant rise in activity became evident. The scientific breakthrough made in the 1970s manifested itself again in patent applications. On average, it takes a period of up to twelve years between the time of the original research and the development of a patent-ready invention as well as between the patent application and its publication.

The development has been especially marked by the patent activity in the United States. Its share doubled from 20

percent in 1975 to 40 percent in 1993. Japan occupies second place in patent activity. However, because of the continuous overall absolute increase in the volume of activity, Japan's share has dropped from 32 percent to 25 percent. The United States has held first place since 1984. As for Germany, after an initial positive development, German patent activity began to stagnate about five years ago. Consequently, Germany's share of patent activity has fallen from 10 percent to 8 percent. The structures and developments observed on the world patent market are also reflected on the German patent market. Since the early 1980s, a steep climb in biotechnology patent applications from about 200 to 2,000 a year is noted.

The greatest share (42 percent) of new product inventions originate in the United States. Germany follows with 16 percent and Japan with 14 percent. Both countries have in recent years displayed about the same development curves. Great Britain and France are represented on the German biotechnology patent market with 6 percent and 5 percent, respectively. Among the activities of other countries that show a positive trend, patent applications originating in Denmark play a surprisingly significant role.

When the invention and innovation activities is the field of biotechnology are examined further, positive development trends—also future-oriented—can be observed in many other areas. Important advances were made in the production of monoclonal antibodies, in the development of bio- and chemo-sensors, in the production of enzymes, co-enzymes, and other proteins, and also in biocatalysis and bioreactions (fermenters). Inventions in genetic engineering are particularly significant in that they account for 40 percent of patent applications of the total number of biotechnology applications.

Patent Applicants with Ten or More Applications: Applications Published in Germany in 1993

Rank	Name	Country	Total number	In genetic engineering
1	Novo Nordisk A/S	DK	36	16
2	The United States of America	US	28	16
3	Boehringer Mannheim GmbH	FRG	23	9
4	Merek & Co. Inc	US	22	6
4	F. Hoffmann-La Roche & Co. AG	CH	22	10
6	Imperial Chemical Industries PLC	GB	19	14
10	E.I. Du Pont de Nemours & Co.	US	17	7
10	University of California	US	17	10
12	Hoechst AG	FRG	16	6
12	Kyowa Hakko Kogyo Co. Ltd.	JP	16	8
15	Max Planck Society eV	FRG	14	9
17	Takeda Chemical Industries Ltd.	JP	12	6
21	Behringwerke AG	FRG	11	3
21	BASF AG	FRG	11	4
21	Institut Pasteur	Fr	11	10

Source: German Patent Office

The number of genetic engineering patent applications has exploded. Between the years 1975 and 1993, in the German patent market (patent applications published in the German Federal Republic), the number rose from zero to 734 per year. The United States, Japan, Germany, and Great Britain contributed most to this development.

Following an initial surge of German patent applications in the 1980s, the number of German applications began to stagnate in 1990. In the face of an expanding total volume, this meant a reduction in the German share on the domestic market. In 1989 that share was 13 percent.

The strong influence of foreign patent applicants on the German market may also be seen in the listing of the major applicants (see Table above). The listing is based on the number of applications published by the German Patent Office and the European Patent Office, effective for Germany 1993. Duplicate counts were avoided. The dominant position of the United States is easy to see. The United States accounts for the greatest number of patent applicants and of patent applications. The predominance of the United States is even more graphically manifested in the special field of genetic engineering. It is particularly noteworthy that the list is headed by a Danish company. The number of state-run and private research institutes among the applicants is surprising great. But that is typical of new fields that grow rapidly and in which the basic research, applied R&D, and the conversion and utilization of the results follow quickly on each other.

Proportional Shares in the German Genetic Engineering Patent Market (1993)

USA	48 percent
Japan	10 percent
Germany	9 percent
Great Britain	8 percent
France	5 percent
The Netherlands	4 percent
Denmark	2 percent
Switzerland	2 percent
Belgium	2 percent
Australia	2 percent
Source: German Patent Office	

Government-level restrictions, especially the stipulations of the genetic engineering law, with its many constraints and restraints in granting approval for genetic engineering work in research and production, are cited over and over again as the main reason for the relatively weak showing of the German research and industrial sectors in biotechnology and genetic engineering in their own country. This criticism reflects the discussion on basic questions. It remains to be seen whether the amended genetic engineering law, which went into effect this year and which makes it much easier to obtain approval for such research, will actually succeed in removing the competitive disadvantages under which German research and industry has had to function.

Photo Caption[not shown]

1. p. 12 (upper center):Successes in biotechnology research are reflected in two stages in the patent statistics. Until 1979 the activities of all countries were at approximately the same high level in this field. However, in 1984 the United States assumed the lead position in biotechnology—a lead which it has held to this day and which is difficult to overcome.

DEFENSE R&D

France: GRAVES Satellite Tracking System Outlined

BR1509093394 Paris AIR AND COSMOS/AVIATION INTERNATIONAL in French 2 Sep 94 p 35

[Article by Christel Tardif: "Space Surveillance System for France"]

[Text] Every day, a large number of satellites are well-positioned to observe France. How many exactly? Which ones? What are their parameters? The data is far too vague. There are military and economic stakes involved. It would be nice to have more detailed information about these satellites: their trajectories, the times they pass over France, where they come from, and last, what their precise missions are. We need "our own orbiting ephemeris."

Unfortunately, as things stand, our country has no ground system capable of analyzing the threat posed by these space systems. Given the increasing number of satellite launches, this gap in our defenses is starting to worry the authorities. Thus the GRAVES project was conceived (standing for Large Network Adapted to Space Surveillance). Proposed by the National Office for Aerospace Design and Research (ONERA), and funded by the Missiles and Space Directorate (DME) and the General Arms Delegation (DGA), the project has just entered its second production phase comprising life-size demonstrations.

GRAVES must ensure the effective monitoring of all satellites capable of observing metropolitan France. This is an ambitious project given the complexity of activity in the earth's orbit. Even if this monitoring is mainly concerned with existing satellites, it would only be really efficient if all orbiting satellites, active or inactive, could be tracked. If we are to believe NASA, there are some 7,000 satellites or objects in orbit measuring more than 10 cm!

The realistic solution opted for by the ONERA made a number of compromises. The monitoring radar will be located in metropolitan France, ignoring low-angle orbits over the equator (of which there are, in fact, very few). Monitoring will also be limited just to low altitudes of less than 1,000 km. According to Gerard Garnier, deputy manager of the ONERA's Synthesis Studies Department, this configuration would still make it possible to track more than 60 percent of satellites, including most of the more threatening ones. This is possible while remaining within a wholly reasonable transmission power range. Naturally, it would have been possible to raise the monitoring altitude to 2,000 km and thus track 85 percent of satellites, but then the required transmission power would have had to be 16 times greater!

To ensure the detection system is as effective as possible, two major conditions were imposed. First, the detection delay (from the time the satellite enters our tracking zone to the time it takes the radar to detect it) must not exceed 24 hours. Since the monitoring radars are the first link in the chain leading to the identification of the satellite's mission, it is essential that the satellite be detected as soon as possible. Moreover, it must be possible to determine the orbit of the detected satellite from a single flyover. This restriction assumes the satellite crosses the monitoring zone at two points.

The practical solution selected is based on a bistatic sweep radar. The monitoring zone is a conical crown with an elevation angle of 10-30 degrees. It consists of a set of eight beams each with an elevation angle of 20 degrees and a relative bearing of 8 degrees. Each beam permanently sweeps a sector with an azimuth angle of 45 degrees (constant transmission) and at a specially-defined sweeping speed.

Each beam is generated by a panel array supplied by an equal number of power transmitters (the demonstration prototype will itself only use two transmission panels and thus only two beams). The reception network is made up of 200 elementary antennas laid out in a circular configuration. Each antenna has an omnidirectional relative bearing ensuring a 10-50 degree elevation angle spread and polarization resistance (the radar wave is returned with polarization imparted by the ionosphere). The reception and transmission networks must be as far apart as possible (100

km) so that the signals can be easily separated and to ensure good relative bearing directivity.

The radar wavelength must not be too weak or it could reflect back off the ionosphere. In reality, the value will vary depending on the time of day, adapting to changes in the atmosphere (i.e. frequency of between 3 and 28 MHz).

This system will make it possible to detect satellites in circular orbits at altitudes of 250 to 1,000 km and at angles of 40-140 degrees in less than a day. They will then be tracked by processing the received Doppler signal which characterizes the satellite's orbit. The ONERA is currently developing a special calculation code for this processing operation adapted for use with parallel computing architectures.

ENERGY, ENVIRONMENT

EU: 1994-98 Clean, Efficient Energy Research Budget Revealed

94WS0489C Paris INDUSTRIES ET TECHNIQUES in French Jul 94 p 14

[Article by Cecile Remy: "One Billion ECU for Clean, Efficient Energy"]

[Text] The European Community has decided to continue to fund research on renewable energy sources, goal gasification, and fuel cells.

Europe has opted for continuity in its 1994-1998 R&D budget for energy technologies. The budget for the period (published in the May 18 1994 Official Journal of the European Communities) is 1 billion ECU.

This is 200 million ECU less than the budget for the preceding period. The last Joule program, managed by the research directorate (G 12), had a budget of 500 million ECU, while the Thermie program, managed by the energy directorate (DG 17), received 700 million. But according to Jane Nopp of Ademe, "this year the E-11 line (nuclear energy), which corresponds to the former Joule and Thermie programs, contains no funding for so-called dissemination activities." In other words, reproduction of an innovative experiment under different conditions, economic or climatic for example. "A separate appropriation of 200 million ECU will need to be made to cover these activities." That would bring the total package back up to 1.2 billion ECU.

French participation in previous programs has been marginal. According to the Ministry of Higher Education and Research, French participants were involved in 81 Joule projects costing a total of... just 19 million ECU. The Industry Ministry's nonexhaustive list of 50 projects in the Thermie program includes a number of [French] participants: Syminex, Coflexip, Bertin, Schlumberger, GEC-Alsthom, New Sulzer Diesel France, Ciments Lafarge, Arene, and Sunwind.

"The Joule and Thermie program designations may be replaced by 'clean and efficient energy technologies,'" according to Jane Nopp. But calls for bids are still going out from DG 12 (research and development) and DG 17 (demonstration and pilot projects). "First calls for bids under the new program will probably be issued about the middle of December."

The research areas selected by the Community are generally the same as in past years, except for a general research program on combustion, and increased emphasis on integration of new technologies into traditional networks and systems. Renewable energies are still being promoted: solar—both photovoltaic and for heating applications—wind power, and biomass. Exploratory research in tidal and geothermal energy, with techniques using dry hot rocks (which involve deeper drilling to exploit the interior heat of our planet), as well as production and clean utilization of hydrogen, are also funded. Finally, the Community is supporting coal gasification and fuel cell projects.

FACTORY AUTOMATION, ROBOTICS

European ESPRIT AIT Project Aims Outlined, Participants Listed

BR2608141894 Luxembourg I AND T MAGAZINE NEWS REVIEW in English Summer 94 p 10

[Unattributed article: "Advanced Information Technology in Design and Manufacturing"]

[Text] Europe's major automotive and aerospace companies have joined forces in AIT [Advanced Information Technology in Design and Manufacturing], a large and ambitious project within the ESPRIT [European Strategic Program for Research and Development in Information Technologies] programme.

It is headed by Daimler-Benz of Germany, which is coordinating the project, and involves 30 other companies from 7 European countries. All make vehicles, aircraft or their components. Significantly, no IT vendors or academic institutions are included in the main consortium. The participants believe that by combining their resources, they can not only address many of their common IT problems, but also reach a consensus on their future requirements.

The consortium's aim is to have standardized IT tools and systems available, which can be configured to meet each company's specific requirements and can easily be implemented. It wants to use existing, industrial IT more effectively and establish a migration strategy towards tools that are more generic and less specific to either the automotive or aerospace industries.

The consortium publicly aired the objectives of the project at the AIT Forum in Brussels in April. The next Forum is scheduled to take place in late October 1994. It will take the form of a working meeting between the consortium partners, other IT users and the IT vendor community.

AIT Consortium

Founder Members: Daimler-Benz, Germany; AEG, Germany; Audi, Germany; BMW, Germany; DASA, Germany; Mercedes-Benz, Germany; VW, Germany; Aerospatiale, France; Dassault Aviation, France; PSA, France; Renault, France; British Aerospace, United Kingdom;

Rover Group, United Kingdom; Alenia, Italy; Fiat, Italy; Magneti Marelli, Italy; Saab Military Aircraft, Sweden; CASA, Spain.

Other Members: Bosch, Germany; Siemens Automotive, France; Reydel, France; Labinal, France; Sedicap Technology, France; Lucas, United Kingdom; Motorola, United Kingdom; Clearplas, United Kingdom; Comau, Italy; Stola, Italy; Fatronik, Spain; Danobat, Spain; AMT Ireland, Rep. of Ireland.

Germany: Robot Programming System Developed to Optimize Production Process

94P60354A Frankfurt/Main FRANKFURTER ZEITUNG/ BLICK DURCH DIE WIRTSCHAFT in German 17 Aug 94 p 8

[Text]A universal robot-programming system for short-run production of large vehicles with innumerable spot and seam welds has been introduced by the European Center for Mechatronics (Professor Dr.-Ing. Paul Drews, Reutershagweg 4, 52074 Aachen). Traditional robot-programming methods such as the Teach-in often lead to interruptions when several thousand connection points must be stored. Using the new method, the developers hope to reduce the number of necessary welds by up to 30 percent while maintaining all safety standards. Structural integrity of the bodies is achieved by increased precision in automatic production. Sensors can be integrated into the system. They allow geometric distortions caused by introduction of heat during welding to be detected. A new strategy for offline programming from scientific and technological viewpoints was also introduced in Aachen. In this case, the entire structure of the workpiece is divided into (partial) segments, so-called cubes. Each of these "subroutine cubes" contains specific data, which can be called up to optimize the production process. For example, the programming system will be used to train the system on a bogie for the Swiss National Railway.

MICROELECTRONICS

Germany: Polymer Chip for Fiber Optic Communications Developed

MI0809083294 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 15 Jul 94 pp 9-10

[Text] Exchanges are the nodes of the communications network, where all the transmission channels converge like threads. How these network nodes can be rendered "optically transparent" for glass fibers, or in other words how lines can be switched between subscribers without first converting the optical signals into electronic signals for switching purposes, is a major research issue.

A fundamental requirement is the creation of a space stage, which must be capable of guiding the signal arriving on one fiber accurately onto the selected output fiber. The basic device for setting up large space stages is the 2x2 space switch (two inputs, two outputs), with which switching networks of any size can be built up.

The Heinrich Hertz Institute of Communications Engineering Berlin GmbH (HHI) has now succeeded in integrating the prototype of a thermo-optically tunable 4x4 switching network consisting of five 2x2 space switches on a polymer base. The result was presented to the international trade this year at OFC'94 in San Jose, California (United States).

The key parameters for space switches are short response times (maximum 10 ms), low switching power, and lack of susceptibility to optical signal polarization. The HHI space switch features response times of under one millisecond at 70-mW switching power, and its polarization sensitivity is below 0.5 dB.

Using polymers thus makes for distinct improvements over the materials studied to date: Space switches made of dielectric crystals (such as lithium niobate) are polarization-sensitive and require sophisticated compensation circuits, added to which they are difficult to integrate. Compared with quartz glass (SiO2), which is not subject to polarization, an equivalent polymer switch requires only one-hundredth of the switching power. Moreover, polymer technology promises considerable advantages in terms of costs.

The basic component is a thermo-optically controlled 2x2 directional coupler: Tiny 0.1-sq.mm microapplicators slightly heat up one of two waveguides positioned close to one another, alter its index of refraction, and thus switch the light from one waveguide to the other.

The HHI polymer chip (which measures 30 mm by 1.7 mm) integrates five of these basic switches into a 4x4 switching matrix. An optical signal can thus be directed from any of the four incoming fibers onto any one of the four outgoing fibers.

The chip was processed in the HHI's polymer technology laboratory. A 3-inch wafer on a silicon substrate yields more than 20 switching matrices of the aforementioned type. During the process, the Si substrate, which also serves as a heat sink, is coated first with an SiO2 buffer layer by means of thermal oxidation, and this is then topped by the BDK:PMMA waveguide layer followed by the upper passivation layer consisting of Teflon AF. A UV [ultraviolet] exposure process is used to structure the monomode waveguide. The microactuators are etched out of a vapor-deposited 0.5-micrometer aluminum film using a wet-chemical process. The overall height of this multilayer structure is no more than 15 micrometers.

The development of the polymer switching matrix was commissioned by Telekom. Additional work with modified layer structures is expected to reduce switching power even further, and the inorganic SiO2 layer will be replaced with an organic passivation coating to this end. The optical transmission properties of a fluorinated waveguide material [poly-(2-fluoroacrylic acid hexafluorispropyl ester)] are also currently being investigated. This polymer has been developed in the course of a BMFT [Federal Ministry of Research and Technology] project and is Hoechst is making it available to the HHI free of charge.

Germany: Heinrich Hertz Institute Develops Optical Tuner

BR2408141794 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 31 May 94 pp 8-9

[Article: "Heinrich Hertz Institute Develops Optical Tuner"]

[Text] The glass fiber cable tuner chip that scientists at the Heinrich Hertz Institute (HHI) in Berlin have now made is only 9 mm long and 0.6 mm wide: A complete wavelength-tunable receiver for fiber optic reception (optical tuner) has for the first time been integrated to a chip.

The advantages, familiar from microelectronics, of miniaturizing electronic circuits by monolithic integration to chips—namely compactness, reliability, and cheap mass production—also apply for optoelectronic telecommunications components. Whether every subscriber who wants to can have access to the "fiber optic data highway" depends on such chips being widely available: Conventional copper connections do not afford sufficient capacity for multimedia services such as video telephone, video conferences, and dial-a- video.

The tiny tuner chip is a key component for the input stages of future glass fiber receivers. It contains a tunable laser as a local oscillator, a waveguide network for guidance, mixing and polarization control of the light waves, and finally a detector unit consisting of two photodiodes and a preamplifier stage. Producing some 100 chips simultaneously on a 2 inch indium phosphide wafer requires 170 procedure steps with 25 mask exposures and seven epitaxies; processing alone currently still takes about six months.

To produce the chip, the team headed by Dr. Helmut Heidrich had to overcome considerable difficulties, for example:

- "selective epitaxy" on parts of the wafer,
- conflicting epitaxy requirements when integrating laser and detector diodes on one chip,
- high-precision coupling of the light waveguide coatings to the laser output ("impact coupling").

The result confounds skeptics even among experts, who had considered monolithic integration of tuner chips impossible because of the technological problems.

Optical tuners are based on the same principle of heterodyne reception as is long established in TV cable tuners and radio receivers, but at much higher frequencies (200 THz instead of below 450 MHz). At the input the light wave is added to the light signal from a local laser through a coupler; the optical input signal's "payload" is then available at the tuner output as an electrical microwave signal for further electronic processing.

Initial measurements of test structures show that they have managed to target the strip waveguides on the laser channel with 1 micron accuracy. At 2 dB, the best values for measured light loss at the point of connection are equal to those theoretically achievable (3 dB was achieved on average). The variable frequency range of the electrically continuously tunable 4 section DBR [distributed Bragg reflector] laser is 5.4 nm (600 GHz) at a light wavelength of 1,548 nm. This means that for a cable width of 10 GHz, 60 OFDM [expansion not known] channels can be dialed separately (each of which can carry a "payload" of 2.5 Gbit/s).

The tuner chip, which has taken 64 man years to develop, was subsidized by the BMFT [Federal Ministry of Research and Technology] within the framework of the Photonics I joint project. The chips are now undergoing extensive tests and are available to the joint project partners for system tests.

The main applications for the OEIC [optoelectronic integrated circuit] receiver are subscriber connections and exchanges in future fiber optic networks. Cheap optical tuners at household fiber optic sockets enabling future subscribers to select TV programs and communications channels like they do with their television set on the copper cable network today are no longer pie in the sky.

France: Axode Launches High-Speed ASIC OCR Chip

94WS0489D Paris INDUSTRIES ET TECHNIQUES in French Jul 94 p 26

[Article by Ridha Loukil: "Axode Puts Character Recognition on ASIC Chip"]

Text] Vision systems faster than existing software applications: a plus for continuous monitoring programs in printing, industry, and GED.

The character-recognition systems marketed by Axode require neither PC [personal computer] nor specific software. Rather, they come in the form of a card that plugs into a simple modular industrial rack that can be set up to read printed and graphic-arts text, control product marking in industry, or triage documents in computerized offices. What does it offer? "Processing speeds 100 times as fast as current software," says Dominique Martin, the company's marketing director.

At the heart of this vision system is an ASIC [application-specific integrated circuit], a type of electronic chip specially designed to replace conventional software used in such applications. Axode developed it in collaboration with the Advanced Engineering School of the West (ESEO) in Angers, as part of a joint venture with four other enterprises. The school provided consulting services, training, and design assistance, with half the costs being covered by Jessica, a program to help PMIs [small and medium-size industries] learn how to build application-specific chips. The result: Axode only had to spend 25,000 French francs [Fr].

The company reportedly built the chip from standard components. The choice of ASIC technology was dictated first by the need for speed, second by the need for integration. Axode took advantage of the opportunity to familiarize itself with ASIC capabilities for future use in other projects. For example, the company is developing a compact system for continuous identification of invoices, tickets, etc., that will read 30-40 characters per second. This project will employ two or three ASICs. Axode is also considering the possibility of acquiring a work station to design them in-house.

The system currently being marketed operates by being taught to recognize characters in a given font. With ASIC, Axode has been able to improve performance and reduce prices for its low-end products to under Fr100,000. Axode expects to use about twenty a year on the vision systems it is marketing. But to amortize development costs more quickly, it also plans to offer them as OEMs [original equipment manufactures] to vision systems builders, in the form of chip cards for use with PCs.

European Microsystems Research Reviewed

BR0809114494 Amsterdam TECHNISCH WEEKBLAD in Dutch 24 Aug p 13

[Article by Rene Raaijmakers: "Europe a Leader in Microsystems"]

[Text] Europe is strong in the area of basic research into microsystems technology. In Belgium and the Netherlands, too, the report "Microsystems Technology, Exporting Opportunities" from the Future of Technology Society (STT) concludes that all the necessary know-how is available.

In the chip industry, Europe has lost the exhausting battle against the Americans and the Japanese. There are still opportunities to be seized. The available knowledge must be translated into products and that is where the problems arise. There is a wide gap between universities and industry. According to the STT report, not enough is yet known by potential users about the advantages of microsystems.

In the report, some 30 scientists and technologists give their views from their own particular field of study on the miniaturization of systems. The result is a jumbled mixture. Microsystems technology (MST) combines just about every imaginable area of research, from chemistry, electronics, plastics, materials, and medical diagnostics, to microbiology. There is no uniform approach. The authors of the report chose as the most important interest areas instrumentation, consumer electronics, agriculture, and the medical world, and enriched the whole with successful examples and challenges.

Nevertheless, there is a solid thread running through it all. The examples which are given in the report are certainly very varied, but every one is a tour de force in its own field. Micro Systems are technological pioneers. They form, as it were, crude sketches of what is awaiting us during the next decades. One of the first lines of the report's final conclusion: "We expect MST to form the basis for a new generation of technological innovations for the coming decades."

An example from this new era is the collision sensor from Analog Devices Incorporated (ADI) from Norwood. It is a sensor which combines IC [Integrated Circuit] technology with micromechanics on 10 square millimeters of silicon. A Netherlands example is the transponder produced by Nedap: a glass injectable capsule for pigs which contains an antenna, a sensor, and an IC for identification. Or else there is the DCC [Digital Compact Disc] head from Philips, with eight magnet-resistive sensor elements able to pick up 90,000 bits every second from a cassette tape.

Yet another microsystem comes from Hewlett Packard [HP]. HP has built a hard disc the size of a matchbox, containing a motor, a magnetic disc, a DSP [Digital Sound Processor] chip, and magnetic sensors. This 1.3 inch Kittyhawk was developed by HP in barely two years. 42.8 megabytes of information fit onto this disc the size of a large coin. In fact, the Kitty Hawk is already out of date, as developments in the hard disc industry, which had an annual turnover of 50 billion dollars in 1993, are in a chaotic state of change. For the forthcoming Comdex computer exhibition, Integral Peripherals has already announced that it has a 1.8 inch (credit card size) disc holding 260 Mbytes, already three times more compact in size.

In fact, there is no unequivocal definition of a microsystem, but the collision detector from Analog Devices provides a good illustration. This sensor is able to detect collisions, carry out self-tests, and ensure communications with the air bag via an integrated circuit, should it be necessary. The basis of the sensor is an actuator structure which was first developed at the University of California at Berkeley. "The sensor is at the same time an actuator," writes Professor Jan Fluitman, of the University of Twente's MESA Institute, in the report. "It provides the best solution for internal calibration. By integrating actuator, sensor and electronics, we have a smart and reliable sensor system." On the other hand, sensors are also required to produce reliable actuators. A flow controller with a micropump, for instance, cannot work without a mass flow sensor.

The report highlights a great need for environmental sensors. "There is a demand for an immense number of environmental sensors - mostly biochemical." Here,too,it appears that self calibration is the only way to obtain reliable measurement data. Fluitman again: "The biggest problems with sensors are drifting, and wear and tear. They cannot be solved simply by using smart electronics. An actuator, and therefore a microsystem, is required."

To be really successful, note must be taken during the miniaturization of systems of a dizzying number of disciplines. Artificial medical microsystems, for instance, an artificial pancreas, include micromechanics (microinsulin pump and flow sensor), biochemistry (glucose sensor), and electronics (communications, regulation), among others. The instrument also needs to be supplied with energy, it must be flawlessly packed, and a solution found for bypassing the body's immune responses. Without any doubt there is the glimmer of a billion dollar market here, but despite great interest an artificial pancreas has not yet been achieved, because there is no implantable glucose sensor yet available.

To give some idea of the present situation, three weeks ago NEC, together with its subsidiary NEC San-ei Instruments, gave a demonstration of a "portable" glucose sensor. The instrument measures the glucose levels in tissue fluid which it painlessly—according to NEC—withdraws through the skin using a suction cap. The equipment is the size of a shoebox, and an insulin pump is not included. We can be assured that it will be a long time before there is an artificial pancreas equal in size to a pacemaker.

In general, the report concludes that the greatest barriers are the complexity of the microsystems and the miniaturization of the energy sources. Then various segments each require a separate, often very specialized, approach. This sometimes creates a bottleneck, as for instance with an implantable glucose sensor.

It will only be possible to realize microsystems if a very intensive approach is adopted. That can be seen from the numerous examples of companies which are deeply involved in this promising field. According to insiders, 30 researchers are working continuously at Texas Instruments on the digital mirror device, a chip containing millions of tiny mirrors by means of which projection TV will be possible. A team of five to ten scientists has been working for years on Yokogawa's high precision pressure meter.

Microtechnology requires miniaturization, but there are still hardly any clear, demonstrable methods of production. Four different speed sensor manufacturers are named in the report. Analog Devices (Norwood) combines its micromechanics and IC on one chip. IC Sensors (Milpitas) has chosen a hybrid form with sensor and IC; the two are manufactured separately, and assembled later. MicroParts (Dortmund) uses its own design in the so-called Liga technology. Sensonor (Oslo) uses simple microtool technology and can even mount the seismic mass on a feather using precision assembly.

Sensonor's crash sensor, two centimeters in size, is primitive compared to the completely integrated system from Analog Devices, but it still achieves a greater success because the collision detectors can be supplied at a much cheaper price. To be able to compete, ADI's integrated sensors—now costing about 120 Dutch guilders each—must be reduced in price.

It is very clear that Analog Devices has succeeded in obtaining a basic technology with this success which it can live on for years. One can imagine advanced vibration detection by additional integration with digital signal processor circuits, another of ADI's core activities.

The investment needed for production technology is enormous. The report gives as an example an MST production line for nickel temperature sensors. Over five years, cleanroom inclusive, this costs about eight million guilders. Ir. Gerben Klein Lebbink of STT points to the fact that successful mass manufactured microsystems will themselves stimulate investment in new facilities.

One of the report's co-authors is looking jealously towards the United States. At the Micro Electronics Center in North Carolina multi-user projects are already being carried out by which various participants in a CMOS [Complementary Metal Oxide Semiconductor] process can integrate simple ICs with micromechanics. "In this way low costs, high yield, and the reliability of standard processes for digital and analog electronics are also set aside for microsystems," writes J. Roggen of Leuven's IMEC [Inter-University Micro Electronics Center]. "If we had such a service in Europe, then integrated microtechnology would also be available for our universities, research laboratories and the SME [Small- and Medium- sized Enterprise]."

Netherlands: Philips Develops Color Enhancement for TV Displays

BR0809111994 Amsterdam TECHNISCH WEEKBLAD in Dutch 24 Aug p 4

[Unattributed article: "Display Screen Colors Improved By Red Phosphor"]

[Text]The world's largest cathode-ray tube manufacturer Philips Display Components has developed a new phosphor which is deep red in color. According to the company, this improves the color reproduction of television sets.

"We want to reproduce colors as true to life as possible," said Jan van Koesveld, of the CRT (Cathode-ray tube) Phosphors Product Unit. "To achieve this, you must use primary colors which lie as much as possible at the vertex of the so-called colors triangle. The new red phosphor fits this requirement."

In a color cathode-ray tube, red, green, and blue phosphors convert the energy from high velocity electrons into light. For consumer applications these are ZnS:CU,Au for green, ZnS:Ag for blue, and Y2O2S:Eu for red. In red phosphors, the invading electrons first of all generate electron-hole pairs in the shadow mask. The energy can then be transferred to the europium activator ions. Eu^{3+} falls back from the position of contact back to the point of emission via radiation-free transitions. This point of emission consists of various layers placed close to each other. During the return to the basic position, beams of various red wave forms are emitted. By adding more of the rare metal europium [Eu], the average fill factor of these emission positions shifts to a lower layer. The wave length of the emitted light changes as a result and becomes deeper red in color.

NUCLEAR R&D

France: VIVITRON Accelerator Used for "Superdeformation" Experiment

94WS0489B Paris AFP SCIENCES in French 4 Aug 94 pp 11-12

[Article: "First VIVITRON Experiment on Superdeformation"]

[Text] Eight years after construction began, VIVITRON is becoming operational at the Center for Nuclear Studies at Strasbourg. The first experiment—a study of superdeformation phenomena—was carried out July 15-19 on the new accelerator, linked to the EUROGAM multidetector in phase two.

According to an announcement from IN2P3 (National Institute for Nuclear and Particle Physics), VIVITRON is generating beams "of good optical quality and excellent stability at voltages that will go as high as 18-20 megavolts [mV] this fall."

A Van de Graaf-type electrostatic accelerator with a high-voltage generator and accelerator tube in a biconical reservoir (1,224 cubic meters [m] in volume, 51 m in length and 8.5 m in diameter at the center), VIVITRON is such an ambitious project that it required innovative construction techniques: Whereas until now the highest voltage used on this type of machine was 25 mV (obtained at Oak

Ridge Laboratory in Tennessee), VIVITRON was designed to support up to 35 mV. Final adjustment problems delayed the first experiment.

EUROGAM is a gamma ray detection package for studying the structure of the nucleus. It was developed by six French and four British laboratories, and construction costs were divided equally between IN2P3 and SERC (Scientific and Engineering Research Council). Phase two of the detector's construction, timed to coincide with completion of VIVITRON, has improved EUROGAM's performance tenfold over phase one, so in terms of resolution it is still the most powerful gamma ray spectrometer in the world.

According to IN2P3, "the expected voltage of 18-20 mV will make possible all the experiments planned with the EUROGAM detector and a large share of those envisaged with other detachable and transportable detectors: detection of charged particles for ICARE and CHARISSA, neutrons for DEMON (Modular Neutron Detector)."

A Franco-Belgian instrument designed to shed new light on the mechanics of reactions produced by heavy ion collisions, DEMON is scheduled to be transferred to VIVITRON in 1995, after an initial series of operations on the Cyclone cyclotron (Nuclear Physics Institute, IPN, of the University of Louvain-la-Neuve) and GANIL (Large Heavy-Ion Accelerator at Caen).

Superdeformation

Observed for the first time at the Daresbury accelerator (Great Britain), superdeformation at high spin (intrinsic kinetic particle momentum) is an excited, relatively stable state of the nucleus, which when rotating rapidly is deformed and takes on a triaxial (along three different axes), ellipsoidal form, eventually reaching a shape like a more or less stretched-out rugby ball (with one axis, for example, twice as long as the other).

The phenomenon, observed in nuclei with masses [i.e atomic weights] of about 130, 150, and 190, is accompanied by emissions of particular gamma wavelengths that are very difficult to detect, given the large amount of background noise, without ultrasensitive, high-resolution detectors.

TELECOMMUNICATIONS

German Research Ministry Funds Telecooperation Projects

MI2908080194 Berlin NTZ in German Jun 94 p 446

[Text] Interactive information systems for wide circles of users are a challenge for practical information technology and management. Especially in times of structural change, rapid information is increasingly a competitive factor for technology-based firms. Experience of general application will now be gained from the demonstration of such an information service system in Mecklenburg-Western Pomerania.

Information Services as a Challenge

As part of the subsidy initiative "Telecooperation and Value- Added Services", the Federal Ministry of Research and Technology (BMFT) is supporting the development of a "Management Research and Technology Information System (Martin)." When fully developed, it will enable technology-based firms and institutes to access extensive information easily via such telecommunications services as ISDN, CompuServe, or Datex-J. The BMFT is funding the initial objective of a technology promotion information and advice system with a total of 1.56 million German marks [DM] over two years.

The proposed system will:

- ensure that up-to-date information on federal and laender government subsidies for technology is always available;
- inform registered users directly of main areas of support, events and deadlines;
- provide interested firms with important data on line,
- assist sponsoring and advisory bodies, ministries, technology centers, and chambers of trade and industry.

Finally, in interactive mode it will provide users with assistance from project preparation to making applications.

Help for Economic Change

There is a requirement for such information primarily in the new laender, which are undergoing extensive economic restructuring. In Mecklenburg-Western Pomerania key sectors of industry like shipbuilding and construction have been privatized; small and medium-sized firms that have been hived off must find their bearings again. Such information services will be created for these firms—now over 100 in Mecklenburg-Western Pomerania alone—to assist them with new technologies, products, and markets.

The database operator, the Mecklenburg-Western Pomerania's Association for Scientific-Technical Information and Documentation in Rostock, has many years' experience in this field: It has offered the "Naval engineering" database since 1970. Traditional contacts with Eastern Europe in particular may give the technology information system an additional profile if it is able to make information about supply and demand in technology and about projects or sponsorship programs from the countries bordering the Baltic available to interested parties in those countries.

The Computer and Communication Systems company in Rostock is responsible for the technical foundations of "Martin". The company is assisted in this by the Computer Science Dept. of Rostock University and by Dornier in Friedrichshafen. Economic Research in Berlin contributes in particular experience in technology consultancy, and technology and sponsorship information prepared for use on information systems.

German Research Minister Urges Expansion of Data Networks

MI2908075994 Leinfelden-Echterdingen COMPUTER ZEITUNG in German 21 Jul 94 p 7

[Text] Federal Research Minister Paul Krueger last week signaled the second round in the dispute about the building of information superhighways in Germany. The minister called for the rapid abolition of all network monopolies, saying that the use of data lines for high speed communications must become cheaper. In so saying, he was accentuating a statement that only three weeks ago had met with

a strong protest from Telekom chief Helmut Ricke. Ricke defends the current data communications tariffs, advocating greater coordination of pilot schemes for multimedia applications. He maintains that the abolition of monopolies is governed by the terms of the second Post Office reform.

Krueger wants to impose more flexible rules here, and his invitation to Telekom is: "We must develop visions jointly." He says Germany already has the infrastructure for information superhighways, but the initial investments required of suppliers are still too high.

"When it comes to promoting the information superhighway, Krueger and Ricke are pulling in the same direction, but from different places," is a Bonn research expert's view of the situation. Behind the dispute is the financing of the joint telecooperation projects already approved. The 35 million German marks [DM] made available by the Research Ministry do not cover the full communications costs. So projects are dependent on concessions from Telekom. But Krueger's critics doubt that any good can come from a quarrel with Ricke.

Germany:Multimedia Systems for Industry Developed

MI0809083694 Berlin NTZ in German No 7. Jul 93 pp 502-505

[Article by Rainer Pollmann: "ISDN Brings Multimedia Applications Into Industry"]

[Text] A "multifunction communications system" for applications in industry is on trial in Gladbeck as part of Teletech NRW, the Land of North Rhine-Westphalia Ministry for Industry, Small and Medium-Sized Enterprises, and Technology telecommunications initiative. This project, the only one of its kind in Germany, sets out to reveal the exploitation potential for multimedia communications via ISDN [integrated services digital network] in industry. Its brief is to develop application scenarios with multifunction communications between geographically distributed divisions of a business.

Telecommunications Lag in Manufacturing Industries

Multimedia communications procedures are gaining increasing ground in many branches, although telecommunications procedures and potential are still being exploited only to a limited degree in the manufacturing industries. Applications to date comprise data transfer between production scheduling computers (transmission of the planned production schedule from head office to the manufacturing locations) and machine tool control diagnosis (remote software service via modem over conventional telephone lines). Nowhere where a considerable amount of verbal and visual clarification is needed in addition to the data itself is the potential held out by multifunction communications (image, sound, and data) yet being exploited.

To the knowledge of Telecim project manager Kasten, however, a rapidly growing demand is emerging from both the economic and ecological points of view. Project leader Hans-Ulrich List, of the Duesseldorf-based Consulting and Engineering Company (GBE) Limited, says, "Involving one's opposite number audiovisually in the manufacturing situation creates greater understanding and makes for a common basis for discussion without requiring his or her presence in person." For instance, simultaneous engineering applications with just-in-time business associates are already being devised for demonstration, process control at suppliers' works, and the function integration of geographically distributed divisions of a business—e.g., engineering, product design, and production—with direct feedback. A distributed machine or factory control system for operation from a central control station (virtual factory) is also being planned.

High-capacity communications systems providing simultaneous video and audio signal and data transmission make for efficient know-how transfer. In firms that have several production locations and an intricate manufacturing structure, a greater need arises for visits by specialists to the various locations to deal with problems on the spot. Indeed, the various specialists can generally only be reached in one place—often head office.

With corporate expansion into the new federal laender, the emergence of system houses and joint ventures, and the development of the internal European market since 1993, individual company locations are spreading even further afield. Moreover, shorter and shorter development times and the need for "leaner" production are increasing the need for communications between the firms or divisions involved in the development and production of a product.

The Project Managers

The overall project, which was launched and is directed by GEB, is being carried out at the Center for Applied Production Engineering and Organization (ZAP) in Gladbeck, which is providing the requisite manufacturing technology infrastructure. DBP [Deutsche Bundespost] Telekom is also taking part: "This project gives Telekom its first chance to test the performance of multifunction communications via ISDN on the industrial manufacturing scene," says Duesseldorf chairman Jochen Kuetter. Even now, ISDN means that DBP Telekom can offer a medium with the performance features of a multifunction communications system (MFCS), as images, sound, and data can be transmitted simultaneously via ISDN. It is also suited to use in engineering and production tasks in the manufacturing industries, although there has hitherto been a complete lack of practical experience with multifunction communications in manufacturing.

The Gladbeck-based Center for Applied Production Engineering and Organization (ZAP) provides manufacturing industry with an opportunity to present its know-how. Its brief is also to grant small and medium-sized mechanical engineering enterprises access to the latest production methods.

Purpose of the Project

The project sets out to create a system for demonstrating the potential of multifunction communications between geographically distant divisions of a mechanical engineering firm for the purposes of design, engineering, NC [numerical control] programming, manufacturing control, production, quality assurance, and maintenance. In this

connection, the project will show examples of the integration of communications into various value-adding industrial manufacturing processes.

The planned outcome of the project is a practicable and marketable pilot application that can be incorporated into a wide variety of sectors of industry. The idea is that it should generate an exemplary application that will make small and medium-sized enterprises aware of the potential and uses of multifunction communications. The initiators hope that the use of this form of communication in industry will show a marked increase after the conclusion of the project.

In addition to the technical potential of a system of this kind, its economic viability will also be studied with special reference to factors such as traveling expenses, absence from the workplace, acceptance, MFCS operating costs, etc. The overall project comprises three phases in which telecommunications will contribute to, respectively, computer-assisted design (CAD) and manufacturing (CAM) and computer-integrated manufacturing (CIM).

Telecim in Brief

Participants in the Project

Project Idea, Support, and Management:

- Consulting and Engineering Company (GBE) Ltd., Duesseldorf
- Application Development Support and Demonstration Center:
- Center for Applied Production Engineering and Organization,

Gladbeck Communications Development Support:

DBP Telekom, Duesseldorf, IKAT Project Team Organization of the Project The Telecim application project comprises three phases:

1. TeleCAD
2. TeleCAM
3. TeleCIM. Further Information Mr. Hans-Ulrich List, GBE Ltd., c/o ZAP Gladbeck Siemensstr. 2-4, D-45966 Gladbeck Tel. 02043/977-127, fax -120

Phase 1:TeleCAD

The TeleCAD phase is setting up a system for demonstrating the feasibility of performing work simultaneously in a CAD application at two workstations in a manufacturing company. The project sets out to draw up application scenarios for subsequent system applications and to adapt the application-specific software:

- installation of two MFCS expansion kits in PC's at the ZAP;
- 128-kbit/s and 384-kbit/s data rates with ISDN main stations for the computer audio and video links;
- drafting of the specifications for LAN [local area network] MFCS applications; LAN communications operation will be tested in phase 2;
- documentation of experience with multifunction communications applications and integration of a CAD workstation into the MFCS.

Phase 2:TeleCAM

In-house operation will be expanded in this phase by linking the system up to the machine control system, and audiovisual communications will be tested in the ZAP's in-house LAN:

- installation of an ISDN dialogue line between the ZAP and the other participants;
- audiovisual communications between designer, NC programmer, and machine operator;
- development of interface adapters between the MFCS and whichever machine control system is selected.

The MFCS will be used in this phase with the performance characteristics achieved by then and new, application-specific functions, the emphasis being on data file transmission, extended remote control by camera, and integrated machine control with remote monitoring applications. Application know-how and joint CAM via MFCS development in Gladbeck and by the other participants will be documented.

Phase 3:TeleCIM

This phase will see the expansion of the machine control application in the direction of factory control, the goal being distributed control over production facilities at various locations. Manufacturing control stations available on the market will be expanded for MFCS with audiovisual communications and remote joint editing functions and tested under actual operating conditions:

- development and testing of MFCS conference communication via ISDN between locations distributed throughout the original and new federal laender;
- integration of a manufacturing control station system in the MFCS environment;
- local operation over the ZAP's house LAN and over the ISDN lines available to the other participants;
- operation at distributed locations via either two or four S0 ISDN interfaces each;
- installation of two additional MFCS's at the ZAP and on the other participants' premises;
- documentation of applications, experience with applications, developments, and benefits of linking MFCS to factory control.

Telekom's Hultzsch on Research Goals: Future Plans

94WS0482A Stuttgart BILD DER WISSENSCHAFT in German No 8, Aug 94 pp 88-89

[Dr. Hagen Hultzsch, on nine-member Telekom board of directors, interviewed by Wolfgang Hess]

[Text]

Rush Hour Without Traffic Jam

Information highways are to strengthen the economy and improve the quality of life. In the coming years telecommunication will again progress drastically. Dr. Hagen Hultzsch, a director of Telekom, sees here an opportunity to improve Germany's competitive position on the international arena.

Since 1993 Dr. Hagen Hultzsch has been on the nine-member Telekom board of directors. Dr. Hultzsch, who is 53 years old, is in charge of telecommunication services engineering. A physics graduate, he was previously responsible for management organization and information systems at the Volkswagen AG. Telekom's 1993 sales volume is 58.5 billion DM.

BdW [BILD DER WISSENSCHAFT]: "Telekom is treating itself to an expensive Technology Center. As a service provider Dr. Hultzsch, do you really need it?"

Hultzsch: "Telekom operates a high-tech network suitable for all modes of telecommunication. Products and services we offer based on this network enable us to transmit messages, data, and a variety of information. Because new innovations are continuously introduced, the operator of such a network wishing to compete with others must prove to be an innovator too. Our services are only as good as their technological base will let them. Therefore, we must always be in step with others at the forefront of developments."

BdW: "Your research thus parallels research done by industry."

Hultzsch: "There is of course some overlapping here, because any service is ultimately equipment-oriented. Our reliability research focuses on the entire network structure, however, in which a manufacturer is not so interested."

BdW: "Has this comprehensive and thus extremely cumbersome approach to reliability, as old as the postal service, not long ago been overshadowed by modern dynamics? In other countries the problem is tackled in simpler ways."

Hultzsch: "In the licensing process we, too, have become more dynamic."

BdW: "What you research and develop makes sense only when it can become accepted internationally. What is Telekom's marketing capability?"

Hultzsch: "We have become quicker and more goal-oriented. We have learned that standards need not be written in stone, ...

BdW ... as was assumed in the past."

Hultzsch: "This was indeed so and, moreover, required long preparations. But now we quite willingly accept tradeoffs, in recognition of the fact that our world is changing tremendously fast. Look at mobile telephones: Products in this line which we have sold three years ago now do not entice anyone any more. Another proof of our change of mind is the quick success we have had in working out the ATM standard."

BdW: "Does one have to know it?"

Hultzsch: "But, of course. Years ago we successfully advanced packet switching networks. Today almost every enterprise uses Datex-P. The volumes of thus intermittently transmitted data require that we provide very large capacities bu' for short periods of time only. We therefore thought of flexible packet switching services so as to enable us to better utilize the network infrastructure without having to invest massively in various special networks. Our idea was to so design the blocks of information that they will unaided follow a given path through the network."

BdW: "Are you not thus building into the data packets some sort of a compass for the road through the network, a compass which enables them to find their destination without further assistance?"

Hultzsch: "The packets have a built-in address head. This head is analyzed before the data reach a distributor switch. Guided by the address head, such a switch decides which way the information should proceed. Unlike on previous occasions, we Europeans have now quickly agreed with the United States as to the content of that address head and in this way established the ATM standard. The acronym ATM stands for Automatic Transfer Mode. One packet contains 53 bytes, 5 of which called headers being used for the transport subroutine".

BdW: "How much information can be transmitted in this way, as compared with the amount transmittable by Datex-P?"

Hultzsch: "With Datex-P we achieve 64 kb/s. With ATM we are pushing into entirely different orders of magnitude. In the broad-band ISDN (Integrated Services Digital Network) pilot project we now realize gross transmission rates of up to 155 Mb/s. This is over 200 times more than with Datex-P. In the future we foresee rates of 622 Mb/s and 2500 Mb/s respectively."

BdW: "The Americans promote the Information Superhighway as a national project. Would you like to have such a program pursued in Germany too?"

Hultzsch: "We in Europe already have the network structure and are even ahead of the United States. As for the use of the available networks, however, the situation is different and we are one order of magnitude behind the Americans. Our enterprises scarcely use electronic mail in their operations and seldom hold video conferences. The American engineer reaches for a data bank hundred times more often than does a Central European one. The massive use of these networks in the United States stimulates faster innovative activity in the field of information technology and thus helps, as a spinoff, opening a worldwide export market for the American information industry."

BdW: "Do you visualize telecommunication as an engine which will pull our slumping national economy out of the mess?"

Hultzsch: "I have two visions. The first one is making it possible for people, by way of telecollaboration, to advance their projects much faster and to thus become more innovative. The second one is making modern network technology improve the quality of life. My goal is to enable you and me to watch together a video-on-demand film whenever we like rather then at a time a television broadcaster has scheduled it for us."

BdW: "Datex-P, video-on-demand, E-mail, ... is their acceptance so poor because the customer does not climb through the jungle of terms and service handbooks and not even notice what blessings this technology has in store for him?"

Hultzsch: "You are taking words out of my mouth. I insist that the systems be self-explanatory and that learning to use them does not require a special education. With electronic mail we have come so far that all commands can be executed via pictograms on the display panel."

BdW: "Fine. But why do you call it video-on-demand and not for instance, personal-request television?"

Hultzsch: "These services were invented in the United States and we have adopted their terminology."

BdW: "I believe the engineers there are making it too easy for themselves and their thinking is not customer-friendly."

Hultzsch: "Perhaps we should really push ahead with such concepts as interactive television or dialog television."

BdW: "It will be some time till dialog television becomes reality. What concretely do you then see descending upon us within the next thousand days?"

Hultzsch: "We will make telecollaboration bring people closer together. We will accelerate movement of the work place into the home. We will also contribute to a more intense information exchanges among colleagues across Europe, not only by way of video conferences but also by discussion of documents and blueprints over telecommunication channels."

BdW: "They are talking about this for a long time already. As you yourself have said, the Europeans do not accept these offers as eagerly as you had hoped for."

Hultzsch: "I am firmly convinced that we will make it now. The number of PC's in Germany has in the meantime reached four million, PC's which can be furnished with a board costing 250 DM and enabling them to transmit texts via an ISDN line to other computers. This technology offers an enormous advantage. For solving an even smallest production problem, it often takes more than a month till all staff members gather at one table. In the telecommunication mode they get together within a few hours."

New Digital Mobile Telephone Network in Europe Profiled

94WS0490A Munich TOP-BUSINESS in German Aug 94 pp 94-97

[Article by Herbert Grab: "A New Giant Awakens"]

[Text]While the whole world is still amazed at the boom in the D networks, a second mobile radio giant is awakening in Europe. Its name is DECT [Digital European Cordless Telecommunications] and its goal is to cut the telephone cord.

The vision is futuristic but in no way unrealistic. The man of tomorrow has only one telephone and one telephone number for both private and business purposes. He will also keep this number his whole life, if he wishes. It makes no difference whether he moves twenty times and it makes no difference whether he is in Regensburg or Rio.

The telephone of the future no longer needs a cord. It operates in the various networks which have merged into one user pool, and it is equipped with all the features that define a convenient ISDN and a mobile radio telephone. The digital standards needed for this were defined a long time ago. These are ISDN, GSM, and, as the most recent standard, DECT, the European standard for cordless telephones.

Even now, as ISDN and GSM networks are being created in Europe and DECT technology has just left the laboratory, the telecommunications branch not only expects a DECT boom but also expects that so-called dual-mode telephone sets will soon be on the market. These sets operate as cordless telephones in the coverage area of a DECT system and as telephones for the D networks as soon as the DECT connection deteriorates. The switch is made either manually or automatically.

All manufacturers of renown are working feverishly to be able to provide the mobile radio providers—in Germany these are DeTeMobil (D1) and Mannesmann Mobilfunk (D2)—with dual-mode technology as soon as possible. Initial prototypes may be available at CeBIT 1995 in Hanover.

Even triple-mode sets are conceivable. As necessary, they also offer access to a so-called PCN network (Personal Communications Network) such as the one known in Germany as E-Plus. This network was opened in Berlin on 27 May of this year. The idea behind these devices is that the telephone selects the best (and, if applicable, most cost-effective) network for the desired connection.

Actually, DECT was to serve initially only as a common basis for digital cordless telephones. However, in DECT, the experts of the ETSI (European Telecommunications Standards Institute) defined a standard that goes far beyond the goals set by its sponsors.

Clean transmission

In contrast to the previous cordless standards, the new standard was designed as a universal access method to various communications networks. With it, voice, data, and even video signals can be transmitted. The transmission rate of up to 384 kilobits per second corresponds to that customary for video conferences. Primarily, however, it can be integrated seamlessly with ISDN and thus provide a standard interface to GSM—consequently to the D networks.

Because of digital signal processing, DECT transmission provides absolutely clear voice quality up to the range limits of the base station (30 to 50 meters in buildings, 250 to 300 meters in the open). In the boundary area, a quiet, unobtrusive warning signal draws attention to the impending loss of the connection.

The entire standard becomes really interesting when used with larger telecommunications systems in which—for example, on one company's property—several cells are interconnected. Thanks to dynamic channel scheduling, DECT provides interruption-free transition from one cell to the other and thus for uniformly optimal connections. This is an important feature primarily for data transmission. Even now, Siemens and other manufacturers have implemented cordless data and video transmission based on DECT.

High capacity

The seamless transition from cell to cell also functions in the other direction. The system always knows the location of all connected mobile telephones within a communications

system. This is true even when these telephones are in other cells. Because of this, the system can forward calls without delay to a user who is underway on the company's grounds.

The Standards: A Basis for Cordless Telecommunications

DECT—Digital European Cordless Telecommunications. The only standard for cordless telephones approved by the European standardization committee ETSI (European Telecommunications Standards Institute) and supported by the EC commission. In two to three years, it is expected that more than half of all new cordless telephones in Europe will be DECT sets.

GSM—Global System for Mobile Communications. The European standard for digital mobile radio networks. The German D networks, with about one and one-half million users, are the largest GSM networks in the world at this time. More than 50 countries worldwide have decided to accept the GSM standard for their mobile radio networks.

In addition, there is a capacity unknown until now for cordless systems. DECT operates with ten frequency bands (channels) that are all served by one base station. A special process, the time/frequency multiplex method, allows up to twelve conversations on one channel in the ideal case. This yields up to 120 parallel telephone calls per base station. Complex encryption algorithms for voice and data provide for extreme privacy.

Bridge to the D network

The new technology is particularly attractive for companies using an ISDN telephone system. Even now, all large manufacturers offer modules that allow such systems to be upgraded for the use of cordless telephones. The advantage is that ISDN features such as call-waiting, three-party service or calling number identification can be used unchanged. However, according to the Philips development head Robert Mulder, the costs for cordless connections in a telephone system are between 20-30 percent greater than those for wired telephones—an extra expense that cannot be calculated in every case. While the new standard will establish itself in the near future as an expanded cordless system capable of supporting ISDN, the GSM network providers are already planning a great coup. This is because DECT, due to an interface to GSM, can close the gap between conventional cordless telephones and the large mobile radio networks.

In concrete terms, a private mobile radio network provider such as Mannesmann Mobilfunk or the new E network company E-Plus could take care of the telecommunication needs of entire industrial centers with local DECT radio networks connected to a large telephone system or a switching center. The voice and data traffic of these lucrative customer groups could then be routed into a private network—bypassing the public landline network. The reverse is also true.

While the D2 managing director Peter Mihatsch will not provide a public declaration as to when and how he wants to open his network for cordless telephones and private branch exchanges, there is no doubt that he intends to do so. The D1 provider DeTeMobil is now in "intensive negotiations regarding the GSM- DECT connection."

Michael Paetsch is responsible at Siemens for business development and strategic planning. He is certain, "that DECT telephones will move ahead on the broadest front possible independent of the D networks in the coming year."

Dynamic development

Many manufacturers and market researchers share this opinion. The Japanese Murata conglomerate is by far the largest manufacturer of passive components for cordless telephones worldwide. The planning data of all large radiotelephone manufacturers converge at this conglomerate. According to these figures, in this year already about 735,000 DECT mobile telephones will leave European factories. In 1995, it will be 1.8 million. From 1996 until 2000, predicts Murata manager Rainer Teschke, the number should be between two and three million every year.

Wolfgang Ptacek is the development and manufacturing manager for cordless telephones at Bosch. He assesses the DECT development as being even more dynamic than Murata does. In his opinion, about 60 percent of all cordless telephones sold in Europe in 1997 will be DECT sets. Ptacek expects a market volume of 6.3 million units in 1997 for the consumer product segment alone.

It is obvious that, in the face of such sales figures, the price is also right. All important manufacturers already have certified DECT telephone sets and the branch expects the great breakthrough to take place at the end of the year—possibly even for the Christmas season. "At that time, the prices will quickly reach the level of top-of-the-line analog cordless telephones," says Michael Paetsch from Siemens.

Contacts Without Cables:What the DECT Standard Brings to the Eastern Economy

The British Scientific Generics issued the invitations to Budapest in mid-April at the behest of the EC. Included were many postal authorities from the east and west as well as managers of network providers and device manufacturers.

The message was that DECT, the European standard for cordless telephones, provides the opportunity to the countries of the former Eastern Bloc of bringing their telecommunications infrastructure up to the state of the most advanced digital technology within a few years.

According to the project manager Behrooz Rashidzadeh, complete local networks can be built based on radio using the new technology. The complex and expensive laying of telephone cables thus belongs to the past—a cost and time factor of gigantic proportions when modernizing networks.

It was no accident that the EC officials selected the eastern European city as the showplace of their demonstration. They wanted to kill several birds with one stone.

First, with the new digital mobile radio technology, they are pushing their foot far into the door of the telecommunications markets of their eastern neighbors.

Second, constructing the infrastructure in the east is proceeding smoothly with the help of DECT—to the benefit of the national economies there and also to the benefit of western sales opportunities.

Third, the more common technologies, the closer the economic and political ties between west and east Europe. This is one goal that lies in the vital interests of the entire continent.

The calculation appears to work out. On the day of the large DECT show, the representatives of the Czech and Slovak telecommunications providers asked Behrooz Rashidzadeh to visit soon.

EU 1994 Telecom Projects, Strategy Summarized

BR2908110994 Luxembourg I AND T MAGAZINE NEWS REVIEW in English Summer 94 pp 5-8

[Unattributed article: "European Commission Activities in the Telecommunications and Information Market During 1994"]

[Text]At the Europe/Japan Forum, held in Paris early June 1994, DG XIII [European Commission's Directorate for Telecommunications, Information Market, and Exploitation of Research] presented an overview paper on the Commission's activities in telecommunications and the information market. It summarizes the objectives and priorities of the Commission's action.

The European Union is currently going through various changes, including its own evolution, resulting from the implementation of the Maastricht Treaty, enlargement, global trade competition, and a crisis in traditional values. Making these changes more acute and compounding them is the fact that growing numbers of people and companies are increasingly able to benefit from fast and easy access to all types of information. In fact, information is becoming a new economic resource which at the same time modifies traditional types of interpersonal relations. This trend is prompting a transformation of European society which will ultimately result in the advent of an "information society". Moreover, as a result of the new role of information and fast communications, remaining economically competitive demands a new quality of communication among the institutions involved in the development and management of society.

To preserve and strengthen the competitiveness of the European Union, the European Commission has an important role to play in this new environment. In this respect, the Directorate-General responsible for Telecommunications, Information Market and Exploitation of Research (DG XIII) plays a leading role. DG XIII already has an outstanding record of activities in the sphere of information and communications achieved through the development of European-wide innovative and balanced policies in the telecommunications and postal services sectors and the launching of a series of original R&D programmes. It has also been very active in technology transfer, information market policy, and the exploitation and dissemination of research results, which is of particular interest to small and medium-sized companies (SMEs).

After achieving major breakthroughs in the field of voice telephony and postal services, the Commission's activities in the area of information and communication will focus on four major lines of action. The first priority is the follow-up of the White Paper.

In this framework, the Commission will make preparations for the establishment of trans-European information infrastructures whose development will bring about a more competitive society as well as foster employment and economic growth. Second, the liberalization of the telecommunications sector will be pursued, with special emphasis on achieving full liberalization of voice telephony by the 1998 deadline and preparing the ground for a more competitive environment in the field of telecommunications infrastructure. Liberalization is also of major importance for securing an active participation of the private sector in the development of information infrastructures. The third priority will be to direct its R&D activities towards developing the technology and applications necessary to enable and support the emergence of the information society. Finally, the Commission will pursue its innovation policy and strengthen technology transfer particularly in favour of SMEs.

Follow Up of the White Paper

The Commission submitted its White Paper on Growth, competitiveness and employment: the challenges and ways forward into the 21st century to the European Council summit of December 1993. The White Paper presents a straightforward portrayal of Europe's difficult economic situation, consisting mainly of the highest unemployment rate since the Second World War, and a decline in Europe's position compared to its main trading partners (the United States and Japan) as regards market shares, R&D activities and the capacity to design and launch new products. It submits an action plan at both the national and Union level to get back to economic growth, boost Europe's competitiveness, and create 15 million new jobs by the turn of the century.

The action plan is organised along the two following themes:

- On the employment front, the White Paper identifies technological and structural unemployment as the main sources of today's high unemployment rate. It thus calls for an overhaul of Europe's employment system, which is only adapted to cyclical unemployment; a drastic reduction in the cost of non-qualified labour; life-long training and education; greater flexibility of the employment market and of internal business organization, and the investigation of new sources of employment.
- As regards growth and competitiveness, the White Paper identifies an open economy, characterized by stability, budgetary discipline, low inflation and interest rates and convergence amongst European Union Member States as a prerequisite for economic recovery.

At the Union level, proposed action comprises full implementation of the internal market and boost competitiveness, the White Paper calls for a sound redirection of R&D activities and the building up of trans-European networks in the field of transport and energy as well as a special focus on biotechnology and audiovisual media. It also stresses the importance of setting up trans-European information infrastructures to get Europe back on track in the long run. The Union will provide pump-priming funding while the private sector will be in charge of the core investments.

Endorsing this analysis, the European Council has drawn up an action plan following the main lines of the White Paper. As regards the information society, it invited a group of prominent personalities representing all relevant industries in the Union to produce a report on specific measures to be considered by the Union and its Member States in this sphere. On the basis of the report, presented at the European Summit in Corfu, Greece, on 24 June, the European Council should adopt an operational programme defining the procedures for action and the necessary means for achieving the goal of setting up trans-European information networks.

The High-Level Group has met several times and is currently in the process of finalizing its report. Its work has been organized along the following lines:

- Identification of obstacles to be removed and actions to be launched at European level to set up a pan-European information infrastructure;
- Identification of a series of concrete projects and application fields of interest to the public.

Telecommunications Policy

The year 1993 was a landmark year on the way towards liberalization of voice telephony, in particular with the Council's commitment to liberalize fully the voice telephony market by 1998 (with a longer period left to Greece, Ireland, Portugal and Spain and, to a lesser extent, Luxembourg). The Council also reached a common position on a draft Directive to apply the Open Network Provision (ONP principles) to voice telephony, adopted a Resolution on universal service, and started discussing a Directive on satellite earth station equipment, which is a first step towards bringing the satellite communications sector in line with the general rules.

The strategy for 1994 is to pursue the removal of barriers in the European Union telecommunications market while maintaining a balance between liberalization and harmonization. The future evolution of telecommunications policy will follow the guidelines presented in the "1993 Telecommunications Review". An important policy document, the Green Paper, on mobile and personal communications, was adopted by the Commission in April.

The main aspects of the telecommunications policy in 1994 are described below:

Open Network Provision (ONP).

The regulatory aspects of liberalization and harmonization measures will continue to be put into place. This consists specifically of the implementation of the ONP Framework Directive for telecommunications. In addition, the Council and the Parliament are currently debating legislation on the application of ONP principles to voice telephony and on the mutual recognition of licenses and other national authorizations for telecommunications services.

Satellite Communications

The following proposals are being discussed by the Council and the Parliament:

- A directive on the mutual recognition of licenses and other national authorizations for satellite networks and services;
- A communication on satellite communications;
- The provision of, and access to, space segment capacity.

Mobile and Personal Communications

Public consultation on the Green Paper on the development of mobile and personal communications approved in April took place in the second quarter of 1994. After this period of public debate, the Council is expected to adopt a resolution endorsing the goals of the Green Paper, and the Commission is expected to make formal proposals for new legislation.

Data Protection A modified and simplified draft Directive on the protection of personal data and privacy in the context of digital telecommunications networks, in particular ISDNs [Integrated Services Digital Networks] and digital mobile networks, is being discussed by the Council and the Parliament.

Directory services The Commission is expected to approve a communication on telecommunications directory services during the year.

Frequencies and Numbering Cooperation mechanisms with the European Conference of Postal and Telecommunications Administrations (CEPT) will be adapted towards a new approach to the management of radio frequencies. Specific work requirements resulting from the Green Paper on mobile communications and other discussions and the availability of radio frequency spectrums will then be undertaken. As regards numbering, the cooperation mechanisms with CEPT will focus on the promotion of European-wide cooperation on the numbering of telecommunications services. Main issues here include equal access, fair interconnection and universal personal telecommunications, with the overall aim of ensuring that further development of the sector is not hampered on numbering grounds.

Implementation of Telecommunications Legislation

The full implementation of Union Directives in the field of telecommunications is of crucial importance in the framework of the internal market. The scope of these Directives is wide and includes services (open networks and competition), terminals (mutual recognition and competition), terrestrial stations equipment for satellite communications (mutual recognition), harmonization of frequencies and numbering, as well as public procurement. An important task to be carried out is to control applications.

Structural Aspects of Telecommunications and Posts

The Maastricht Treaty places grate emphasis on economic and social cohesion within the Union. Work in this field will encompass the adoption of the new operational programmes funded by the Structural Funds for the 1994-1999 period and ensure that there is continuity with the programmes and projects of the 1988-1993 period, both within the Community Support Frameworks and the Community Initiatives Programme.

Trans-European Networks

Euro-ISDN: Legislation on the convergence and interoperability of Euro-ISDN throughout the Union is currently being discussed by the Council and the Parliament. Furthermore, the preparation of the fourth annual progress report on the harmonized introduction of Euro-ISDN in the Member States is currently under way.

TEN-IBC (trans-European networks integrated broadband communications): In preparation for future Union actions to stimulate the emergence of high-speed trans-European networks, a number of feasibility studies and trials will be executed on TEN- IBC. One of the main objectives is the development of an action framework for the sector's players, thus drawing the maximum benefit from the Union dimension.

Advanced Television Services

All Member States and the Commission reached agreement in 1993 on the following elements: the launch of a four-year action plan worth ECU228 million for the introduction of advanced television services in Europe, the revision of the existing Directive on TV standards and preparation for the future of digital television.

Priorities in 1994 include:

- The implementation of the action plan for the introduction of advanced television services in Europe is expected to be finalized in June;
- The Directive on the use of standards for television broadcasting which repeals and replaces the existing MAC Directive is being negotiated with the Council and the Parliament;
- The Commission communication on "Digital video broadcasting - A framework for Community policy" is being discussed by the Council and the Parliament. It is envisaged that the council will adopt a Resolution on this matter which the commission will start implementing during the remainder of the year.

Postal Services

Following the end of public debate on the Green Paper on postal services, in February 1994 the council adopted a Resolution on postal services. The Commission will present draft measures necessary for setting up a European Union postal policy, in particular on the definition of the concept of universal service, quality issues and the separation between public regulators and public operators.

International Cooperation

Top priority in 1994 will be given to international negotiations on the worldwide liberalization of the telecommunications sector following the successful completion of the Uruguay Round, in particular with other industrialized countries, with a special emphasis on market access, public procurement and standards.

At all levels, particular attention will be devoted to relations with the United States and Japan. Consultation mechanisms will be used to their full extent with European Union partners, including, for example bilateral negotiations with Australia, Canada, Israel, Switzerland, the countries of Central and Eastern Europe and the Commonwealth of Independent States (CIS).

Science and technology cooperation in the field of telecommunications and telematics applications will continue to take place with Central and Eastern Europe and the CIS countries, and other developing countries such as China, India, the Mediterranean countries and Latin America.

The Framework Programme

Under the third Framework Programme (1990-1994), specific programmes in the field of information and communication consisted of communications technologies (RACE [Research and Development in Advanced Communications for Europe]), telematics systems of general interest, the exploitation and validation of R&D results (VALUE II), and information technologies (ESPRIT [European Strategic Program for Research and Development in Information Technologies]).

The new programmes under the fourth Framework Programme adopted in March 1994 are:

- Telematics applications of common interest (TELEMATICS);
- Advanced communications technologies and services (ACTS);
- Information technologies (IT);
- Dissemination and optimization of R&D results.

Under the Fourth Framework Programme, TELEMATICS and ACTS will constitute a major part of the R&D basis for the implementation of the White Paper's policies for growth, competitiveness and employment. In particular, they will provide the R&D basis for the development of trans-European high-speed information infrastructures, digital video services and telework.

Advanced Telecommunications Technologies and Services

Until this year, research and technology in advanced communications (RACE) within the third Framework Programme was organized along the following lines:

- Verification of high-speed network interoperation;
- Development of personal and mobile telecommunications;
- Development and demonstration of integrated service engineering;
- Digital image communications;
- Open network security;
- Advanced communications experiments in the car industry as well as in rural areas.

A number of accompanying measures were launched in January 1994 with the aim of:

- Stimulating the development of telework in Europe;
- Ensuring a rapid development of digital video services and television;
- Facilitating the participation of organizations from less- favoured regions in future Union R&D activities in advanced communications and telematics;
- Promoting the mobility of researchers in advanced communications through fellowships for visiting researchers to work with RACE project teams.

Telematics Applications

Telematics applications are the result of a growing convergence between telecommunications, computer and broadcasting technologies. The successful introduction of telematics applications throughout Europe will make a major contribution to consolidating the internal market,

improving the quality of life and working conditions of European citizens, increasing business and administration management efficiency, stimulating economic growth, and boosting employment in new service markets.

The following seven domains were covered by TELEMATICS under the third Framework Programme:

- Road transport with the Dedicated Road Infrastructure for Vehicle Safety in Europe programme (DRIVE);
- Health care with the Advanced Informatics in Medicine programme (AIM);
- Distance education an training with the Development of European Learning through Technological Advance programme (DELTA);
- Administration with the European Nervous System programme;
- Rural areas with the Opportunities for application and communication technologies in Rural Areas programme (ORA);
- Linguistic research and engineering;
- Libraries. To the seven domains already covered, the new TELEMATICS programme will add the following under the new Framework Programme:
- The Technology Initiative for Disable and Elderly People (TIDE), which will be integrated in the fourth Framework Programme;
- Tele-management of European air traffic;
- Extension of the Rural Areas programme to urban areas;
- Telematics for the environment, such as monitoring of air and water pollution as well as surveillance of nuclear and chemical plants;
- Telematics engineering, which will consist of application engineering (optimal integration of generic equipment, networks and services with specific equipment and software) and process engineering (identification and analysis of changes to be made to the user's environment to successfully introduce telematic applications);
- Information engineering, which will cover advanced electronic publishing systems, new database structures to improve access to and usability and management of information, as well as cooperative R&D networks.

Exploitation of Research and Innovation: The VALUE Programme

VALUE II, the programme for the dissemination and use of scientific and technological research results, is responsible for disseminating these through publications and databases, and protecting them through patents. It enables businesses to exploit research results to the full, thus encouraging business innovation. In 1993, the efficiency of these actions was improved with the development of the CORDIS information service comprising nine databases and the establishment of a relay center network in Member States to promote R&D activities and the dissemination of their results.

VALUE is now focusing on the following activities:

- Financing the selected offers for the new interfaces;
- Evaluating proposals for the validation action and submitting a selection to the Commission;
- Reviewing a Commission draft Decision on the rights and obligations of partners in Union R&D actions in the field of dissemination and validation, to be submitted to the VALUE committee for eventual adoption.
- Improving the efficiency and user-friendliness of CORDIS.

The SPRINT Programme

In 1993, the aims of SPRINT (Strategic Programme for Innovation and Technology Transfer) were:

- To facilitate the diffusion of new technologies to companies through projects and research and technology organizations (RTOs) networks;
- To launch a new scheme, "Managing the integration of new technology", to promote the absorption of new technologies by SMEs;
- To encourage the use of management techniques by decisionmakers.

SPRINT's three main lines of action for 1994 are:

- To develop European innovation services infrastructures through the strengthening of technology transfer networks such as RTOs and science parks as well as accompanying measures;
- To pursue the 21 specific projects for transnational technology transfer currently under way;
- To monitor cooperation between the Commission and the Member States in the field of innovation and technology transfer.

Information Market and Systems: The IMPACT Programme

The IMPACT II [Information Market Policy Actions] programme aims at developing the information industry in Europe by removing barriers of all natures and stimulating European initiatives. In 1993, the information market observatory reported a continued high growth in the information market, especially in the multimedia sector. To encourage this trend, IMPACT has supported over 80 feasibility projects in multimedia and geographical information systems, and the legal advisory board was strengthened. Awareness and user training also continued to grow: the ECHO host generated around 5,000 connect hours per month.

The main priorities are:

- To pursue the work of the Legal Advisory Board (LAB), especially on the Council draft data protection Directive and on the legal protection of databases. Furthermore, a White Paper on the legal issues affecting [incomplete sentence as published]
- To improve the achievements of the information market observatory;
- To stimulate the standardization process;
- To prepare for post-IMPACT activities (beyond 1995).

Security of Information Systems

The legal base for the action plan in the area of the security information systems expires in 1994 and a proposal for a

further phase of actions will be drafted. A wide consultation on a draft Green Paper on information security issues will also take place.

Main areas of activities will cover:

- Work on electronic signature applications using networked trusted third-party services;
- Continued work on the 1993 programme activities, which aim to promote the information technologies security evaluation criteria (ITSEC) approach to a wider audience as well as proposing improvements;
- Co-operation with our North American partners, especially for the development of common security evaluation criteria, for which a draft for public comment could be issued during the second half of 1994.

EU Telecom Council Agrees on Digital TV Policy Resolution

BR2608141794 Luxembourg I AND T MAGAZINE NEWS REVIEW in English Summer 94 p 4

[Unattributed article: "Towards a Community Digital TV Policy"]

[Text]Meeting on Monday, 30 May 1994, the Telecommunications Council reached political agreement on a resolution establishing the framework for a Community digital television policy, but postponed a Decision on the proposal relating to transmission standards.

The final decision to drop D2Mac and HD-Mac as compulsory transmission standards in favour of a new more flexible framework depends on the technical work on standards; the Council took note of the state of the work on this subject.

The Resolution on the framework for a Community policy states that, in order to ensure the "harmonious development" of digital technologies, the Council "awaits with great interest" any agreement that could be concluded—on a voluntary basis—by those concerned, including broadcasters. In the absence of adequate consensus and should the necessity of guaranteeing fair and open competition require it, the Council is prepared to take regulatory measures to help this process.

The Council welcomed the Commission's plan to include actions in this area in its proposals for specific research programmes (fourth Framework Programme), to encourage the process of standardization of digital TV and the development of implementation scenarios for digital TV broadcasting, to support studies on the availability of frequencies and strategic questions related to these, and to maintain a political dialogue with other countries, notably the United States and Japan.

The Council also noted that the consultation with industry on conditional access to programmes was not yet completed and that the Commission and the Member States must undertake additional work to determine further measures.

EU Parliament Selects Four Broadband Communication Projects

BR2608141694 Luxembourg I AND T MAGAZINE NEWS REVIEW in English Summer 94 p 11

[Unattributed article: "Interworking via Optical Networks"]

[Text]In a specific action, the European Parliament took the initiative to stimulate the demonstration of optical fiber-based communications for illustrating the interworking between centres of excellence. This action was to be seen in the context of preparing for trans-European broadband networks.

Following a call for proposals, four projects have been selected:

- 12001 Isabel;
- 12002 Tironet;
- 12003 Betel;
- 12004 HPC-Vision.

12001 Isabel

Isabel has interconnected two existing IBC [integrated broadband communications] islands, RIA in Aveiro (Portugal) and RECIBA in Madrid (Spain), in two successive steps.

- The first step made available two 2 Mbits/s links from the beginning of the project.
- The second step introduced ATM [asynchronous transfer mode] between the two cities, transporting the ATM cells through a plesiochronous link working at 34 Mbits/s.

12002 Tironet

Tironet has implemented a broadband service connection between a metropolitan area network in Dublin and an SDH network in Northern Ireland, based on the existing optical infrastructure, with enhancements to existing nodes to ensure a minimum throughput of 4 Mbits/s. British Telecom Northern Ireland owns the optical link to the South and was responsible for the transnational link. The link has a minimum capacity of 4 Mbit/s with a further increase to 34 Mbits/s.

12003 Betel

Betel has established a 34 Mbits/s cross-connected platform over trans-European borders. This platform has interconnected FDDI [fiber-distributed data interface] LANs [local area networks] in Geneva, Lyon and Sophia-Antipolis. A Connectionless Broadband Data Service was provided and each end terminal connected to BETEL using an E.164 addressing scheme.

12004 HPC-Vision

HPC-Vision has setup a 34 Mbits/s link over trans-European borders using existing facilities between Strasbourg and Karlsruhe. The project has used the connection to join existing systems installed in both locations.

France: Connecting Into Information Superhighway Considered: Cost, Technology Analysis

94WS0498A Paris LE MONDE INFORMATIQUE in French 8 Jul 94 p 28

[Article by Ian Corns: "Deciding on 'Access Roads'"]

[Text] Some optical fiber segments of the future information superhighway already exist. The problem is how to provide access to them, starting with the existing "departmentals." And at what cost?

Contrary to general belief, fiber optic information highways already exist in France. The problem today is not so much building the network as affording access to it. Technically, the solution is quite simple. All that's needed is a connection line running to home or place of business. Whether that link is a coaxial cable of the kind used for TV antennas or twisted-pair telephone cable, users currently are connected by copper wire to the fiber optic networks. It is the "copper" part that needs to be eliminated and replaced by optical fiber to allow two-way information flow (voice, data, images).

The problem is the cost of providing such a connection. According to French cable companies (leading with Generale des Eaux and Lyonnaise des Eaux), a changeover to fiber optic terminal connections able to adapt existing infrastructure to a fiber optic dial-up network would require an investment on the order of 200 billion French francs [Fr] as a bare minimum. Are we prepared to pay the price? At this point the answer is no, given the fact that installation of a copper or cable outlet costs about 400 Fr while the cost of a fiber optic hook-up "in your own home" is more than 20,000 Fr. Moreover, even if rates are lower for enterprises than private individuals, a fiber optic dial-up network would not, except for transmission of animated video, offer capabilities beyond those already supported by existing infrastructure and operations.

In the meantime, before this [fiber optic] solution, already fully mature from a technical standpoint, passes into general use, there already exist "low-tech" ways of using existing communication arteries that take these monetary and temporal constraints into account. Every country has its own strategy for doing this. The Americans, the Japanese, and the French all use completely different connection techniques. Standards, infrastructure, the number of cable operators (less than ten in France, more than 1,400 in the United States), and the weight of various players differ greatly. Operator monopolies in certain countries (France), and relatively heavy government influence in others (United States), are variables that directly influence the techniques and methods that will be selected to connect and provide access to these superhighways.

Numeris: Express Lane

France, for once, may be behind its big American brother in this segment of the data processing and telecommunications domain. It is not cause for alarm; France's position is not that hopeless. In fact, people may be surprised to learn how much progress has already been made. A technological upgrade of this scope cannot be realized overnight. In view of all that's at stake, we will have to proceed step by step, with an incremental approach.

The first step is to upgrade and speed up our own Minitel [video terminal of the French telecommunications system], currently hobbled by a slow data transmission rate (see below). This solution, TVR [High-Speed Teletel], is already available and should be in relatively wide use within the next few months. It offers access to videotext services at speeds on the order of 9,600 bps [bits per second]. It is clearly recognized this is only a temporary solution, limited in terms of the services supported. Especially since these same services can be obtained with a microcomputer (and communications software) connected to a modem. Increasing the installed base of microcomputers in France and installing more high-speed modems (faster than 19,200 bps) is a further stage, one we must reach as quickly as possible, in order to prepare for future superhighway applications. While these first two stages are adequate for transmitting text and stationary images, they cannot handle multimedia applications that integrate voice, data, and animated images. Here the problem is quite different, since it's not enough just to receive information, however well it may be synchronized. An excellent example of this new domain is teleconferencing, a technology for holding meetings of people physically located in different places using a television network to link the participants. To provide this service, France has its Numeris network. Despite the fact that its data transmission speeds are too slow to support high volumes of information and video on demand, the technical quality of the network gets better every day. But alas, this communications tool remains very costly and is intended mainly for companies. According to many experts, Numeris needs a larger customer base, i.e. it should offer mass-market services at attractive rates, much lower than those presently charged. Expanding Numeris, by offering more attractive prices, is thus a high priority.

Digital Telephone

The new Digital Subscriber Line (DSL) technologies offer another means of connection to the future superhighways. Developed by the Bellcore laboratory (United States), with protocols and standards now being elaborated, these techniques would give our traditional telephone outlets, without further conversion, a transmission potential of several million bps. Their introduction on the French market, as usual in the telecommunications domain, will depend on the decisions of France Telecom.

Finally, it is possible to expand existing cable television networks (1.4 million subscribers in France) so as to reach every household, then create video services as needed by linking the networks to RTC [public switched telephone network]. That will be the final step before construction of a system-wide, integrated dial-up fiber optic network.

France Telecom's Minitel Factor

94WS0498B Paris LE MONDE INFORMATIQUE in French 8 Jul 94 p 29

[Article by Henri Pradenc: "Microcomputers, the Future of France 'On-Line'"]

[Text]In the last 12 years, on-line services in France have won international renown. Their strong points: kiosk services and a solid regulatory system. The main weakness: Minitel's terminal is conceptually obsolete. Its future lies in upgrading to match microcomputer functionalities.

What kind of terminal will it take to give private individuals and industrial users access to knowledge and information from the future high-speed "information superhighways"? Television, microcomputer, Minitel, or advanced

telephone terminal? In France, the question cannot even be asked without reference to Minitel. After 12 years, the French on-line system consists of 9,600 service providers residing on some 4,200 servers. The culture and activity that has grown up around Minitel affects everyone's lives. "'Information superhighways' are an opportunity for France Telecom, as well as for the service companies, which with Minitel have paved the way for multimedia," says Daniel Lechanteux, director general of AT&T France.

But what do these service providers have going for them as they head into the future world of interactive multimedia applications integrating data, images, and sound? "Providers have learned a great deal about ergonomics. In terms of market approach, we know what makes one service more successful than another. Also, from a technical standpoint, we are ready for multimedia services," says Jean-Luc Lenart, general manager of Axime. Another advantage for service providers: the sophistication of French users. "The French market could have higher usage than others, because people are already accustomed to keyboards and computer screens, thanks to Minitel," opines Antoine Weil, director of the "Voice, Text, and Image" division of Matra Communication. In that regard, it is striking to note the difficulty Americans have using the home banking service launched in the United States by EDS [Electronic Data Systems] in collaboration with France Telecom and US West Telephone Company; Frenchmen are completely comfortable with it.

Watchdog

The success of Minitel in France stems from the commitment made in the early 1980s by the national telecommunications operator to make an electronic directory available for users. But the key to the on-line service's growth was inauguration of the "kiosk" system, whereby service providers are remunerated by France Telecom, which puts users' charges for access to service providers on their phone bill. This system leaves the operator in an awkward situation vis-a-vis the user, who may contest the quality of service provided. France Telecom has thus also had to act as a consumer watchdog, to minimize or avoid disputes. Thus a contract signed with each service provider specifies conditions of access to the kiosk service, for example mandatory on-screen posting of service rates.

In the United States, a number of kiosks providing voice service have been installed. But operators are not interested in moving further down that path. In France, by contrast, kiosks have seen tremendous growth. Starting with a single service rate, it now has eight different price levels.

One of the strengths of the French on-line system is the existence of an institutional regulatory framework. Officially created in February 1993, the High Council on Telematics (CST) and the Committee on Public Telematics (CTA) replace institutions that were created at Minitel's debut but ran into chronic operational problems. Their differing composition and the number of members was reduced. The CST is responsible for setting guidelines on acceptable practices, while CTA enforces the rules. Their jurisdiction includes all public on-line computing, both kiosk and non-kiosk. France Telecom is actively exporting its expertise on ethical standards to other European operators. Also, an initiative is under way with other operators to harmonize regulations in the on-line domain.

No Discontinuity

While French on-line expertise enjoys international renown, Minitel itself is conceptually obsolete. Originally, it responded to the need to make available to users a rudimentary, easy-to-operate terminal, with all the "intelligence" located in the server. Today, screens and keyboards are a normal part of everyone's life. Users have new demands, and as a consequence, Minitel must evolve. But France Telecom rejects any discontinuous change. There is no question of consigning to the scrap-heap overnight the 6.5 million Minitels or 500,000 modems and emulators for microcomputers installed in households and industry. The changeover, as the Minitel terminal upgrades to microcomputer functionality, will be gradual. In the first phase, Minitel will add support for transactions.

"For users desiring to make transactions, we will offer them a new gamut of Minitels that allow them to make remote payment from their home," announces Daniel Le Rest, deputy chief of Teletel product lines. The new Minitel will come with an integrated reader that can process bank cards and commercial discount cards. Remote payment via Facitel bank card has been undergoing field tests since late last year; the system, created by BNP [National Bank of Paris], SNCF [French National Railroads], France Telecom, and Air Inter, will offer such services as flower ordering, vacation reservations, insurance, and sales of tickets for events. The new terminal will go on the market at the end of the year. There are also plans to launch in mid-1995 a terminal equipped with modems giving access to Teletel services at 9,600 bps, which is eight times as fast as the current equipment. In a parallel development, France Telecom has come up with a marketing package under the name "Djinn" that includes a modem and software to transform a Macintosh or IBM-PC type microcomputer into a Minitel for professionals.

Numeris Connection

The fast Minitel opens the way to services in which images will play an increasing role. It will be possible to put photographs on the screen. "We look favorably on the idea of moving toward a Minitel that supports photographic-quality images. But France Telecom would have to put a very large number of those machines in circulation, to open the market up for image browsing," notes Daniel Saintho-rant, director of innovation at ODA [expansion unknown].

But the great turning point will come with Numeris. Between now and the end of the year, testing should get under way on possible use of the 64 Kbps [kilobytes per second] offered by one channel. This is the sort of data artery needed to transmit highest-resolution images and bring us a step closer to multimedia. "At that point, the terminal will be a microcomputer," predicts Daniel Le Rest. That point might very well be reached toward the end of 1996, when on-line services via Numeris will go on the market.

In its multimedia strategy, France Telecom plans to liven up Minitel with the help of technologies just now hitting the market. Hence the alliance with General Magic company. The French operator is interested in the new forms of access and new kinds of transaction made possible by "agents"

created using the Telescript communication language developed by the American company. France Telecom is also intrigued by the firm's Magic Cap operating system.

Will the expertise of the French on-line data processing community, combined with the new technological ingredients—all under the sober and cautious strategic direction of France Telecom—be enough to assure France a fully successful entry into the era of "information superhighways"? In a global context, it is clear that Minitel does not carry much weight vis-a-vis microcomputers and Windows-type standards.

However, the needs of the marketplace must be satisfied somehow until such time as fiber optic access infrastructure is fully deployed. "Until 'information superhighways' really exist, there is still a lot of 'business' that can be transacted with a more powerful Minitel," says Francois Legrand, marketing director for video communication at Datapoint.

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